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THE MISUSE OF PETITIONS IN PUBLIC IMPROVEMENT WORK

By Boyle Workman, President of Los Angeles City Council, Los Angeles, Calif.

In the City of Los Angeles practically all public improvement has been constructed under the provisions of the Street Improvement Act, commonly known as the Improvement Act of 1911.

Bonds for these improvements have been issued under the bond provisions of the same act. All improvements are initiated by petition of property owners and it has been the practice of the City of Los Angeles to require that the petitions represent at least 51% of the frontage to be improved, before ordering proceedings for the carrying out of the improvement.

These petitions for public improvement are not a requirement of the state law but a practice established years ago to protect the city from incurring preparatory expenses. The law requires that an ordinance of intention be passed and posted on the street to be improved. This ordinance must state the exact location of the improvement and the class of the improvement. The preparation and posting of this ordinance requires expenses in the offices of the City Engineer, the City Attorney and the City Clerk. The interested property owners have the legal right of protesting the improvement and the money expended by the city for these expenses is wasted if the improvements are abandoned upon presentation of a majority protest. By requiring in advance a majority petition asking for the improvement the City Council protects the tax payers from a waste of their money.

This procedure applies to all kinds of improvements such as sewers, ornamental lighting posts, paving of streets, cement curbs, sidewalks, etc.

Of late years and particularly since the present Council of Los Angeles took office on July 1, 1925, abuses of the present method of initiating public improvements have crept in, largely due to neighborhood differences of opinion. In many cases, it must be admitted, these feuds have been started by the companies which have various kinds of pavement, street lighting posts and other materials to sell.

For example, we received a majority petition asking for blank paving on a street, only to be confronted after the preliminary engineering work has been done, with a majority protesting against the blank pavement. The protestants declare that if the blank paving proceedings are abandoned by the City Council, new petitions would be filed asking for concrete pavement, and many of the protestants were signers of the original petition asking for the blank pavement.

Under the proceedings which have been in use in Los Angeles and now being abused, any person may apply at the office of the City Engineer for a petition to be circulated in a district in which the improvement is desired. On application this petition is prepared in proper form by a member of the City Engineer's office, and delivered to the applicant. It has been found in many instances that petitions represent certain interests who are desirous of promoting street improvements in order that they may sell their products for the improvement thereof. These interests, instead of appearing themselves, induce some property owner residing in the district, to secure the petitions from the office of the City Engineer and they thereafter turn the petition over to paid circulators who secure the signatures of the proper percentage of property owners. Sometimes the property owner is convinced that the improvement is needed and that the particular kind of improvement which the interests wish to secure is the proper type of improvement for the district. The property owner unwittingly lends his assistance to these interests making it possible for them to get through a majority petition specifying that the improvement is to be made of products which they are desirous of selling.

In other case it would seem that certain concessions are given to certain property owners in case they will secere the requisite number of signatures thereon.

It is very often the case that the property owner is not informed as to the type of improvement he is petitioning for nor as to the cost thereof. Then, as a result, he later finds, much to his chagrin, that the cost is far beyond what he thought it would be and that possibly the type of improvement is much too elaborate for the character of the neighborhood in which he resides.

Very often we find that a party holding title to a piece of property will sign a petition for a public improvement after he has sold the property on contract. The contract generally provides that the con-

tract vendee is to assume all assessments and the result is that the innocent purchaser finds, when the notices of the proposed improvement are posted in his district, that he not only has to pay for his property, but for a heavy assessment as well. In many cases it becomes very difficult to carry this charge and still complete the payments on his property. This is especially true in cases on new subdivisions.

We find many cases in which a concern manufacturing certain types of material will cause a petition to be circulated in a neighborhood and a rival concern, learning of the petition, and desiring to have its own product used in the construction of the improvement, will immediately get busy and cause a majority protest to be made against the improvement, under the provisions of the Street Improvement Act, which gives that privilege, the result is, we have a large percentage petitioning for an improvement and in many cases just as many protesting against it. It is then up to the City Council to make a decision as to whether or not the improvement should be made.

Also under the provisions of the Street Improvement Act, the City Council sustains the protest of the property owners and orders the proceedings for the construction to be abandoned. By doing this, however, it loses jurisdiction to initiate new proceedings for a period of six months.

Very often property owners are desirous of having a pavement laid but are opposed, for instance, to having ornamental lights installed. In order to prevent the installation of the lights, they will protest against the entire improvement with the result that the whole proceeding must be abandoned, thereby depriving the City Council of the privilege of ordering the needed part of the improvement for a period of six months.

These rival concerns will work among the property owners and cause a bitter feud between those who favor one or the other types of improvement. Considerable dissension is caused in this manner and in many cases the City Council, in determining what is to be done, has to bear the brunt of the conflict.

Now, as I have said before, if the parties circulating the petitions have secured the required number of signatures, the petition is presented to the City Council. If the petition represents a majority of the frontage desiring the improvement, the City Engineer and the City Attorney are instructed to prepare the plans and specifications and the necessary ordinances, as required by the State Improvement Act. After the engineer has prepared the plans and specifiations and the ordinance of intention, this ordinance is passed by the Council and presented to the Mayor for his approval. The district in which the improvement is to be made is posted with notices of public work. The property owner then finds, to his amazement, that the type of improvement is entirely different from the one for which he signed, and the cost is more than he was led to believe was the case when he signed the improvement petition. As a conseqcence, he files a protest against either part or the entire improvement or against the particular type of improvement.

The property owner is not altogether free from blame in causing this condition to exist. He accepts without question, the statement of the person who is circulating the petition, as to the kind of improvement to be made and as to the cost thereof.

Every petition states in heavy black type that the petition is not being circulated by, or at the request of the City government, but the property owner gives full faith and credit to all representations that are made and affixes his signature to the petition without taking the trouble to read it over. In many instances he acts under the belief that the City government has caused the petition to be circulated although such a statement may not be made by the party circulating the petition. As a result, he later discovers that he has signed for a type of improvement that he only does not want, but one that he is entirely opposed to.

Los Angeles City has under way, to be completed this fiscal year, a $35,000,000 public improvement program which includes the paving of streets, the laying of curbs, sidewalks, gutters, storm drains and sewers. More than 99 per cent of this work was petitioned for by the property owners of the city during the past two years. This tremendous outlay of property owners' money has caused the members of the City Council to give considerable thought and effort to work out a method whereby the abuses of the petitions may be overcome.

The Council is very much in favor of the matter of public improvements being taken up by improvement associations

and being worked out in a systematic manner and on an economical basis. As a general rule, the property owner acts in good faith and is desirous of having all improvements made and is willing to bear his portion of the cost, but he acts without investigating into the projected work and learning what the true situation is.

The members of the City Council are now at work preparing a form of petition which it is hoped will in a large measure overcome many of the difficulties that now exist.

For example, in the case of sewer construction a method has been devised where a majority of the property owners have not specified the type of pipe to be used in the improvement. The City Engineer is instructed to call for bids for the pipe from different concerns manufacturing same, prior to the preparation of the ordinance of intention for the improvement where the sewer is to be laid. Then, after the bids are received, the type of pipe is specified in the ordinance. As a result of this we have completely eliminated a conflict which was waged between the different companies manufacturing sewer pipe, with a substantial monetary gain to the property owners in securing the cheaper product.

Now, out of the experience the Los Angeles City Council has had with the petition method of initiating such improvements, there have crystallized some recommendations of reform to the end that the City Treasury will be protected from useless preliminary expenses for preparing public improvement ordinances and at the same time will encourage public improvement programs as well as the property owners who are in need of these improvements.

The members of the League of California Municipalities may find in these recommendations something that may be of value in assisting them to solve similar problems that exist in other California cities.

The question will naturally arise, now that you have told us the troubles of the Los Angeles City Council in handling public improvements by petition, what are you going to do about it? How do you expect to eliminate these abuses that have crept in? And the following suggestions are offered to answer the questions:

First: In place of the petitions now in use, the City Council is at work on a new, simpler form of petition, printed in large type, with the hope that because of its brevity the property owners will read it before signing. This new form of petition will contain a description of the improvement and the approximate cost.

Second: The securing of these petition blanks will be supervised. That is, property owners desiring to pave their streets and applying to the City Engineer for blank petitions will be referred to an employe of the department whose business it will be to interview these property owners and investigate the street to be improved, then recommend to the Engineer the type of pavement which should be laid under the existing conditions. It may be found that the street is to be widened and that to pave the street at this time would be a waste of the property owners' money. It may be found that the grade of the street will not provide a run-off for winter storm waters and that a storm drain is needed before the permanent pavement is laid. It may be found that several kinds of pavement would equally serve the street, in which case the City Engineer should advise the property owners as to the costs of the different types of pavement and let them decide for themselves which type they should use.

Third: The City Council will continue to encourage associations to lead in securing petitions for the type of improvement necessary for the street, to circulate these petitions and to bring the various interests together into an agreement as to the needs and desirability of the improvement. This work of the improvement associations exists, such as the Hollywood Chamber of Commerce and the Greater Washington Boulevard Association. All differences have been settled in these districts, all engineering advice secured and adopted before the majority petitions reached the City Council. Proceedings thus worked up have gone through rapidly and the contracts were awarded and the work put through in record time.

Fourth: When a majority protest is presented after the improvement is strongly recommended by the City Engineer as necessary for the benefit of the district and the city as a whole, the Council will assert its privilege of denying the protest and ordering the work to proceed. Improvements thus carefully considered and approved before petitions are handed out for circulation among property owners will be of benefit to the district as well as to the rest of the city.

Fifth: The initiation by the City Council of public improvements which have not been petitioned for. I call special attention to this as the present Los Angeles City Council will, of its own motion, start many public improvements during its administration. Included in these will be many of the street opening and widening projects recommend by the Major Traffic Street Plan.

This plan was prepared by city planning experts: Messrs. Cheney, Bartholomew and Olmstead, and sponsored by the Los Angeles Traffic Commission, recommending the opening and widening of a number of streets, converting them into traffic arteries for relief from street congestion from which the city is suffering. The people of Los Angeles by an overwhelming vote approved of this plan and authorized a bond issue of $5,000,000 from which contributions will be made to the assessment districts to pay for these improvements.

Many of these street openings and widenings must be initiated by the City Council, if these streets are ever to be widened and opened. Authority to do this was given by the people of Los Angeles and in the next two years will see in Los Angeles a growing disposition by the City Council to act on its own initiative in the matter of public improvements.

The foregoing paper by Mr. Workman was presented at the 1925 meeting of the League of California Municipalities.

WATER METERING SITUATION AT ERIE, PA.

By D. W. Harper, Water Commissioner, Erie, Pa.

The Erie Water Department is an unusual organization—in fact it is unique in the State of Pennsylvania in that it is the only Water Department in the State, instituted and still operating under a special act of the Legislature. This legislation was enacted April 4th, 1867. and under its provisions, the Commissioners were to be appointed by the Judges of the Court of Common Pleas of Erie County.

Pursuant to this Act, the Judge appointed three Commissioners and the Commission commenced to function with energy. The City Council voted a bond issue of $675,000. A contract was then let by the Water Commissioners for the construction of a pumping plant, the installation of pumps and all necessary equipment for a station with a capacity of four million gallons daily (but the first year's pumpage averaged about 182,000 gallons per day.) From this modest beginning the Department has grown to its present proportions and last year pumped an average of 22,216,418 gallons per day and many days going as high as 33,000,000 gallons. (There are a number of manufacturing plants, each pumping for its own use, more water than the Water Department pumps.) It has been the constant aim of the Commissioners not only to keep pace with the growth of the city but to keep in advance of said growth, realizing the importance to the city of a well ordered Water Department.

With the exception that the City Council must approve of the rates, rules and regulations for the sale of water, the Water Commissioners have full authority and control of the Water Department.

For many years the intake and pumping facilities of the Department were adequate to take care of not only their immediate demands for water but there were also ample excess facilities to provide for the normal growth of the city. During this period, there is no record of any discussion for the sale of water other than on the flat rate basis. However, as industrial consumers began to use water in larger quantities it became apparent that these consumers should be metered. The manufacturers assented to this as an entirely reasonable and proper method, and, on March 12th, 1883, a schedule of meter rates was prepared, regularly submitted to the City Council, and approved by them. Reference to this meter rate, as approved, is interesting, in that it was at least a gesture in the direction of conserving water, by providing that meters might be attached to any premises. It reads as follows:

"Meters may be attached to any premises, where city water is used, as the Commissioners shall direct, but, in no case, shall the charge be less than is required by the schedule of annual rates. In all cases, where the quantity of water used, as ascertained by the meter, exceeds in value the amount to which the premises are liable by the schedule of annual rates, said excess of water will be charged for at meter rates. When more than one meter is required on any premises, the cost of each meter after the first, together with the expense of setting the same and keeping it in re-

pair, shall be borne by the owner of the property."

For reasons which are not important to discuss at this time, the Commissioners felt that an application of this schedule to domestic consumers would not be satisfactory and the flat fixture rates were continued. From time to time there have been modifications of the schedule above referred to but always with the same general result.

Again there was a long period of apparent satisfaction with the sale of water on this combination schedule of flat fixture rates for domestic consumers and metering for large consumers.

About fifteen years ago, however, due to the unusual growth of the city and especially the coming to Erie of very large manufacturing plants, who were large water users, the pumping facilities and intake pipe were taxed to capacity and it became necessary to provide for increased capacity for the intake pipe and install larger and more modern pumping equipment. In addition to this, it became necessary to extend the intake pipe out into the lake and provide settling basins, filter plant and chemical treatment of the water, these last items for sanitary reasons. These installations taxed the revenues of the Department severely and forcibly brought to the Commissioners' attention, the importance of the conservation of water.

From the beginning, the Commissioners were cognizant of the fact that there was considerable waste of water especially on the part of domestic consumers and a system of house to house inspection was inaugurated in an effort to reduce this waste, but with only indifferent success, and this waste still continues.

From time to time, they earnestly discussed the question of putting all consumers on a meter basis—not only to eliminate the above referred to waste of water but being convinced that to sell water other than by meter was manifestly unfair in the first instance to the Department but even more unfair to the conservative user of water.

The larger economic phase of the proposition was constantly recurring to the Commissioners, i. e.: Obviously, the considerable waste of water, plus the rapid growth of the city, would soon call for an additional intake pipe and a new pumping station. The estimated cost of this improvement would be not less than $2,000,000. It was equally clear to the Commissioners that this large expenditure could be deferred for a number of years, if the waste estimated at approximately 8,000,000 gallons per day, could be eliminated and the only way in which the Commissioners felt this could be accomplished was by the installation of meters for all consumers.

The position of the Commissioners on this question was not based on theory but upon the experience of cities all over the country, which had already gone through the same difficulty, with which Erie was confronted.

In the year 1918, the Commissioners took up actively the question of universal metering and employed a competent corps of engineers to make a rate investigation and set up a schedule of meter rates which their investigation would indicate was fair and proper for application in Erie. This investigation was accordingly made and a meter schedule set up. This was duly submitted to the Council and after considerable discussion failed of approval by them.

We are quite free to say, that, in our opinion the failure of the Council to approve this, was due entirely to their not being in close enough touch with the serious situuation in which the Water Commissioners found themselves and also that they were influenced by the quite natural fear which has been present in every city all over the country, when meters were proposed: Viz: That the installation of meters would prevent the proper use of water as well as increase the charge to the public. That these fears are groundless, is readily proven by a canvas of metered cities throughout the country.

For several years after 1918, the metering question lay dormant as far as the general public was concerned but it was a constant subject of discussion by the Water Commissioners. It could not be otherwise, as the daily pumping reports showed that the extreme capacity of the intake pipe, was being rapidly approached. The theoretical capacity of the intake is 40,000,000 gallons per 24 hours but under the most favorable conditions and for periods of 10 and 15 minutes only, the best it has been able to do is 37,000,000 gallons. During the extremely hot weather as well as the severely cold spells, the pumpage has run as high as 33,000,000 gallons per day. This leaves all too close a margin and

has given the Commissioners much concern, and, believing that either universal metering will have to be adopted or preparations made for the providing of an additional intake pipe and a new pumping station, they approached the City Council in 1924 with a schedule of meter rates and urged that they take early action upon this very important subject.

The Council and Mayor gave the proposed schedule earnest consideration but frankly stated that they did not feel that they were sufficiently familiar with all the factors entering into the problem to act intelligently or hurriedly and they therefore employed a rate expert to investigate the whole subject and report to them on his findings. This investigation is now under way and we have reason to believe that with this earnest method of approach on the part of the Council, the Commissioners will have the cooperation and support of the Council in establishing a meter schedule.

It seems unnecessary in a meeting like this to take up time to prove the wisdom of universal metering, but it nevertheless seems appropriate, to cite a very few examples from many available, in support of the contention of the Commissioners of Water Works in the city of Erie, that the very best thing for the citizens themselves is that all consumers should be metered at as early a date as possible.

For example, the city of Grand Rapids, Michigan, makes the following comparative statement of water consumption before and after metering:

Year	Population	No. of Services	Metered	Av. Daily Pumpage
1912	120,000	21,121	53%	15,833,000
1922	145,947	29,018	100%	15,250,000

Please observe that with the increase in population of 26,000 there was a reduction in the daily average pumpage of about 600,000 gallons per day. This is a very fair demonstration of the soundness of the argument for meters.

Again—a more recent example—in fact, one that is now under way: The City Manager of Wheeling, West Virginia, has provided us with some very remarkable figures in the way of reduction in pumpage, due to the setting of meters before the metering process has been one-half completed:

Daily pumpage, 1922.....21,823,000
Daily pumpage, 1925 (only 30% metered) 13,600,000

A comprehensive survey of the State of Ohio has recently been made by the State Board of Health with respect to metering water consumption. The conclusion of this report is to the effect that "for all cities and villages of Ohio, with service metered 100%, the average daily consumption is 90 gallons per capita and that for cities and villages with no metered service, the average daily consumption is 170 gallons per capita."

In passing, is it well to note that the per capita consumption in Erie for 1924 was 184 gallons.

The City of Chicago, after long discussion has, by a vote of two to one, authorized universal metering in that city. It was established that fully one-half of the entire pumpage was being wasted and with this fact before them, Chicago promptly decided upon metering.

We know of no city, metering its water supply, where the people do not use sufficient water or where, once metered, the city would consent to return to a flat system.

The foregoing paper by Mr. Harper was read at the 1925 meeting of the Central States Section of the American Works Association, at Erie, Pa., on October 9-10.

IRRESPONSIBLE CONTRACTOR SHOULD BE ELIMINATED

By S. M. Williams, The Autocar Co., Ardmore, Pa.

I am very much afraid that to a large extent there is not that understanding or appreciation of "Mutual Dependence" between the various elements of construction which is not only justified but necessary. We are all so engaged in our own individual element that we fail to see the others and realize how closely they are all related, and how much they depend upon one another.

We are expending annually in general construction throughout the United States approximately $6,000,000,000 of which $1,000,000,000 is for highway construction and maintenance. The interest of the public demands in that expenditure the greatest economy consistent with efficiency.

I am not going to criticize any one because we may not agree as to the causes for present conditions in the construction industry, but I do believe there are some fundamentals that are worthy of serious consideration.

First, the attitude of the general public has been one of indifference as to proper methods and policies, but ever ready to point the finger of suspicion towards the public official who attempted to award the contract upon the basis of ability, finance and experience—rather than merely the price. This attitude has resulted in heavy losses to communities due to increased inefficiency, because in the majority of public work throughout the United States, the question of responsibility has been interpreted not as ability to perform a contract, but ability to purchase a bond. Price should be a controlling factor but it should be thoroughly backed by ability.

If we are to get away from present conditions, the public must first realize that the present conditions are not economical and to the best interests of communities. It must demand of public officials not entirely price consideration but economy based upon efficiency. The public must then stand behind their officials in their efforts to secure such results.

The public official must consider his responsibility and the result of his work. He should assure himself of the qualifications of the proposed contractor and do it in such a manner that will answer any criticism or charge of unfairness.

The public official should have in so far as possible no doubt as to the estimated cost of proposed work, and those estimates should be fair and just. There is no economy in awarding a contract at a price below what is known from experience to be a fair price. If any industry is to succeed and become of value to a community, it must be encouraged by a living profit and not be discouraged by recognizing inefficiency. Failures in contract performance increase responsibilities and administration expense. I believe that if the facts were known, every dollar supposed to have been saved by awarding a contract at a figure below an intelligently estimated cost has penalized the communities several times more than the supposed savings.

In one of our large States a recent change in method of awarding contracts has been adopted. The Attorney-General of Ohio ruled early last year that it was not the duty of the public official to award the contract to the lowest responsible bidder. At that time it was the common practice (and still is an many States) to determine responsibility by the ability to purchase a bond. That purchase of a bond under these circumstances does not mean anything is indicated by the fact that the president of one of the largest bonding companies reecntly stated in a committee report, "Practically any contractor, whatever his financial standing, whatever his experience or lack of experience, whatever the relation of his liquid assets to the amount of work he has on hand, whatever the extent to which he has become over-extended, can obtain a bond. Some surety company will execute a bond for him."

The Attorney-General ruled it was the duty of the Department of Highways and Public Works of Ohio to award their contracts to the lowest and best bidder and that the word "best" must take into consideration all of the qualifications of the bidder.

In another State the Highway Department realizing the necessity of definitely establishing the responsibility and experience of the bidder, adopted on March 20 of last year a policy which required the bidders to give complete statements covering finance, experience and equipment. This policy has already saved that State a great deal of money because it has encouraged responsible and experienced contractors to bid upon its work, and discouraged irresponsibility and inexperience. On February 16 an important conference was held in Washington, D. C., consisting of committees from the American Association of State Highway Officials, the Bureau of Public Roads, the Associated General Contractors, the American Society of Civil Engineers, American Society of Consulting Engineers, American Society of Mechanical Engineers, the American Institute of Architects, the Manufacturers of Equipment and Materials and representatives of the United States Departments of War, Treasury and Interior. After careful consideration of the uneconomic and unsatisfactory conditions creating inefficiency in public and private construction, the conference recommended among other things —"That both public and private owners adopt a comprehensive uniform questionnaire, covering skill, integrity and responsibility that will be submitted by all contractors bidding upon construction work." The questionnaire is now being prepared by a committee representing the various organizations of the conference.

The surety companies realize that the present methods of bond writing are encouraging irresponsibility, resulting in losses aggregating each year many mil-

lions of dollars. The surety companies reported in five States alone losses in highway construction for the first half of the 1924 season were between thirty and forty million dollars. These losses cause delays in completion of contracts, thereby resulting in further loss to the communities due to postponed use of the improvements.

The surety companies' existence must be justified as an economic necessity, rather than an influence towards losses. They must realize an obligation to communities because they are allied with public work. An official of a prominent surety company recently said—"The surety companies will prosper most when those with whom they have relations also prosper." The public officials in dealing with surety matters should be privileged to deal more with surety company officials who understand practical construction problems and less with attorneys whose lack of understanding frequently results in unnecessary litigation.

The contractor must also be fair with not only the public official, but himself, and being fair with himself, means he must be willing to give the same square deal to those with whom he is dealing including his subcontractors. Unfortunately, we find some contractors who demand the square deal, but are not willing to give it. Such a contractor is a detriment to the construction industry.

The Equipment Manufacturers and Producers of Materials have a decided obligation, but their individual positions differ somewhat. With the exception of a few States, the equipment manufacturers are not protected under the bond. Personally, I do not believe in the value of such protection. I am sure that in many cases it has encouraged careless selling and as manufacturers of equipment, we realize it is dangerous to encourage any bad practice. The equipment manufacturers in many cases should take their place along side of the surety companies and plead guilty to their participation in past practices resulting in the present state of affairs.

If the equipment manufacturers meet their obligation to the construction industry, they must base their sales policies upon conservation and not greed. The sales policies should not permit encouragement of new entries into the construction field solely for the purpose of making sales. Every sale of equipment should be based, first upon the conservative needs of the contractor and second, upon his ability to pay without undue risks.

Regardless of their being protected under bond, the materials producers have an obligation of cooperation with the construction industry because they are a part of it and, therefore, should be willing to do their share in helping to stabilize the industry. It is time that all of the elements of construction should realize that they have a mutual obligation.

The public officials, the contractors, the surety companies and the manufacturers must unite in a sincere effort to give the public that to which it is entitled.

THE MOTOR BUS IN OUR TRANSPORTATION SYSTEM

By Samuel D. Pepper, Member Michigan Public Utilities Commission, State House, Lansing, Mich.

(Editor's Note: The following paper was read before the Utilities Section of the American Bar Association meeting at Detroit, Mich., Sept. 1, 1925.)

Coming, as I do, from a State that takes the lead in the production of automotive vehicles, it is only natural to assume that I am a firm believer in that industry, and in the use of its products. But it is not because Michigan industries have this product to sell, but because the automotive industry marks the second greatest stage of advance in transportation business in the history of the world that I am constrained to the views which I shall attempt to express this evening.

Transportation, in its simplest phase, is nothing more or less than the carrying of persons or property from place to place, according to the needs of the human race. It would doubtless be mere triteness to say that the ancients got along with very simple means of transportation—and yet until one hundred years ago the means of transportation used throughout the world consisted chiefly of sailing vessels and wheeled vehicles drawn by animal power. In this connection the wheel and the sail may be classed as inventions, the use of which goes back to the remotest recorded history. The astonishing thing about it is that people of the eighteenth century were no further advanced in the means of transportation than were the Romans, or the Greeks, or the Sumerians or Egyptians, or the other peoples of six thousand years ago.

With the invention of the steam engine came the first great advance. The steam

engine, of course, made it possible for the modern means of navigation, and the development of the railroad. Electricity as a motive power in transportation was thought forty years ago to be second only to the development of the steam railroad. But due, perhaps, to the limits in natural production of electricity, and the diversion of the limited supply to more useful fields of industry, the electric railroad as such has not, and perhaps will not, progress beyond the short-haul stage in any country such as the United States where the distances are so very great.

The invention of the gas engine with the consequent development of the automotive vehicle is then, in my judgment, the second greatest advance in the field of transportation. The automobile alone, as it is used in this country, proves my assertion beyond question. Today, practically every family in the United States owns an automobile, and thus has its own means of transportation within certain limits. The only limit to the employment of the motor vehicle is the buying power of the public. The automobile as a future means of transportation, however, depends upon two factors, namely, the cost of fuel, and the cost of highway up-keep. Up to the present time automotive fuel has remained comparatively cheap and the public has been willing to contribute liberally to the building and improvement of necessary highways.

The motor bus (and I include therein the motor truck) is only a natural development of the automobile. These vehicles are capable in the aggregate, of handling a very large percentage of all of our transportation business. Their employment, however, on the larger scales is dependent upon factors that will always limit their use, namely, dependency upon highway conditions, high cost of operating, and impracticability for the longer hauls. In that respect the motor bus or truck can not expect to progress much farther than the electric railroads. The prinicpal drawback is the low unit of capacity haul. The great advantage of the steam railroad is the great capacity of its trains, and the comparatively cheap cost of operating a single train.

The motor bus, for example, operates as a single unit of one car with at least one man to operate it. A train of twenty-five such cars is inconceivable. Every car must have its driver. A truck is limited to a very short unit, requiring at least one man for two cars. A freight train of fifty to seventy-five cars, on the other hand, is operated by four to five men. A similar train on the highways requires at least thirty men; and a similar number of motor buses would require from fifty to seventy-five men. The cost of the personnel, therefore, is and must be very much higher on motorbus transportation than on the steam railroads.

With this in mind it is not difficult to understand that a motor bus or truck will always be limited to short hauls and frequent deliveries.

The short-haul business, however, of itself is a very important one, and, therefore, it offers to the motor bus and truck a field capable of very great development, and one which has never been entirely or satisfactorily handled by the railroads. The railroad has, it is true, developed communities immediately on its lines, but it has not supplied the transportation needs of territory and communities not so fortunately situated. It is this class of territory and community that the motor bus and motor truck can reach in addition to their other uses. Railroads with their vast investments must live in fertile territory. The motor bus on the other hand can go into the highways and byways and by its mobility get into territory that railroads could never reach or afford to go into.

The automotive highway carrier business has developed very rapidly since 1915. The bus business, however, began with extremely crude vehicles, little better than the stage coach of ancient memory. Today, we have large comfortable vehicles, capable of carrying thirty to forty passengers per vehicles, and of making distances from town to town as fast as the highway laws will allow. This method of travel has certainly caught the popular fancy, its early crudities have been overcome, and, in Michigan, for example, more people are being carried by motor bus than by the railroads. Naturally this new means of transportation has attracted the attention of our legislatures: First, to secure safety and responsibility; and second, to protect the highways, and help provide for highway improvement and up-keep. In many states a third object has been sought, viz., to protect the railroad from runious competition. The State laws on this subject are, of course, very far from being uniform. The one most uniform provision is that relating to certificates of public convenience and necessity. But even in that respect the State statutes differ widely. Many states do not attempt to

regulate any but the common carriers for hire, on fixed routes and between fixed termini, while some have included all who use the highways for hire, whether as common carriers or as contract carriers for hire.

The application of such state laws has given rise to many controversial questions, both as to policy and of construction. I shall not attempt to review here all such questions, with which you are no doubt quite familiar, but shall limit my discussion to some four or five points that seem of greatest importance at this time.

As might be expected—the question of interstate commerce arose almost at once as the states moved to control and regulote this new system of transportation; because the motor vehicle operates between states as easily as it operates within a single state. Three leading cases have been decided by the United States Supreme Court involving the interstate commerce clause, viz.: The Duke case, which went up from Michigan, the Buck case from Washington State, and the Brush case from Maryland.

The Duke Cartage case involved the construction of the Michigan law, under a provision of which all motor vehicle carriers operating for hire over fixed routes and between fixed termini were declared to be common carriers, and made subject to the public convenience and necessity provision—additional taxes, insurance, and certain general regulations. The Duke Cartage Company was operating over a fixed route, between fixed termini, but carried merchandise for three concerns only, and under special contract. The United States Supreme Court held that the State had no authority to compel this company to be a common carrier, and that therefore it did not come within the provisions of the Michigan law. As a result of this decision, not only the interstate contract carriers have escaped from the Michigan Act, but the intrastate contract carriers as well. The Michigan Commission is confronted with the problem that constantly arises as to when a motor carrier is a contract carrier and when it is a common carrier. We find in some cases that a carrier will solicit business throughout a territory, offering to contract with each individual customer, and when he has obtained customers up to his capacity, whether it be five or twenty-five, he will then cease soliciting and settle down to the contracts that he has been able to obtain. Thereafter he calls himself a contract carrier—when he loses a customer or two he goes out and solicits more business. I assume, however, that the question of whether or not a man is a common carrier or a contract carrier is dependent upon all of the facts, and that the Commission might well be justified in holding certain alleged contract carriers to be common carriers, notwithstanding the subterfuges that are often employed.

The Buck case, involving a construction of the Washington statutes, flatly denies to the states the power to prohibit or regulate motor vehicle carriers when engaged solely in interstate commerce. The holding in this case disregards all of the purposes of state regulations. It was thought perhaps that the Supreme Court was somewhat influenced in its decision by the fact that the highways there in question were federally aided, and undoubtedly that fact was taken into consideration. But in the Bush case which followed, involving the Maryland statute, the court clearly stated that their decision did not rest upon the question of federal aid, but because the statute invaded a field reserved by the commerce clause for federal regulation.

As a result of these two decisions the state regulation, as it has been conceived, can not be applied to interstate commerce. This is a situation that calls for immediate remedy. There is no doubt that carriers by motor vehicles ought to be subject to reasonable regulations such as the states have sought to impose—and as the problems involved are largely local, Congress should, in making regulations, recognize the superior position of the states to enforce regulations that will meet such local conditions. The federal control of this business will never prove satisfactory, and at least if there should be federal regulation, it should be of the most general character with a large measure of authority left with the several states.

The railroads have been complaining quite bitterly of the competition from motor buses and trucks. This complaint takes into consideration only one fact, namely, that buses and trucks are getting business that the railroads used to carry. It is the same kind of complaint that steam railroads made against electric railroads, and that the ancient stage coaches made against the steam railroads. If the motor bus and truck become a permanent factor in our transportation system, it will be because of merit and

natural evolution in mechanics. The outcome of a struggle between two or more means of transportation, if they remain in competitive situations, is not difficult to guess. The public will always choose the means that is the most convenient at the time, and the patronage will naturally be split up. There is no doubt that the steam and electric railroads have lost considerable business to the motor buses and trucks. But the steam railroads particularly have received vast volumes of freight from the automotive industry, which has been authoritatively stated as being fifteen per cent of all merchandise carried.

In a country the size of the United States the steam railroad is sure to survive. It is largely a matter of adjustment. The railroads themselves of late have been conceding the utility of the motor bus and truck, and are preparing for their permanent place in our transportation system. The railroads ought to protect themselves—use the bus and truck to supplement their own carrying facilities—and there is no reason that I can see why a railroad should not be given the power by law to operate a bus or truck line within its own territory. It should, however, be subject to the same rules of convenience and necessity as other operators. In Michigan, most of the electric lines are preparing to supplement their systems by buses, and through the means of subsidiary companies, are actually tapping territory that they never could have reached otherwise. The public, in a sense, is indifferent as to who does its carrying, so long as it gets the service it feels itself entitled to. The wiser railroad managements in this country appreciate this fact. It must be remembered that the transportation business is one of the oldest in the world, and is also one of continuous business necessity. New means of transportation can not be prohibited, simply because of established systems. To do so would be to shut the door to improvements and human ingenuity. It is perhaps too early to predict the outcome as between the steam railroad and the automotive vehicle. It may be a question of the price of fuel, or it may be that the general cost of operating buses and trucks will retard the new system. As matters stand today, however, the motor vehicle is the largest single factor in our transportation system, aside from the steam railroad.

What we need is improvement in the method of handling motor vehicle transportation, a higher sense of responsibility in its operation, and, above all co-operation between the older methods of transportation and the new.

MUNICIPAL FINANCE FOR STREET IMPROVEMENT

By George C. Warren, Chairman, Executive Committee, Warren Brothers Co., 9 Cambridge St., Boston, Mass.

In a paper before the A. S. M. I. published in its proceedings for the year 1917, I used the following expression:

"The fact, as the writer believes, that payment for street improvement or renewals entirely from general funds of the municipality is a very uneconomic system of finance, is perhaps best proven by the fact that, naming a city which has followed that plan for a considerable number of years, you have almost if not absolutely to a certainty named a city which is either poorly paved or is carrying the load of a heavy bonded indebtedness created for the laying of pavements. Generally both such undesirable features are the result of such a system."

In the speaker's judgment, that is as true today as it was at that time and he has never heard of any one questioning correctness of that broad statement.

Modern demands for City pavements, both as to quantity and quality, to meet the ever-increasing motor vehicle traffic, are such that no City accomplishes much toward meeting that demand through its annual tax budget.

There are three general modes of payment practiced by different municipalities under their laws and charters, which vary, not only with general laws of the several States, but with individual or class charters within each State. These are enumerated as follows:

1. General tax, the City paying the entire cost, with no frontage or district assessment against abutting property.
2. District assessment.
3. Special improvement assessment against abutting property for the whole or varying percentages of the cost.

Let us discuss these in some detail.

General Tax

Of all the various methods of meeting the cost of City pavements, this seems to the speaker to be of the least desirable, from the point of view of the taxpayer's interest, because it necessarily limits the amount of improvement to either:

(a) Funds available from City Budget

and Annual Tax Rate, which is always inadequate to meet economic demand for extended street improvement:

(b) Funds available from sale of City Bonds, which generally means either (and usually both) term of bond payment far beyond reasonable life of pavements laid or excessive bond issues to be met by succeeding generations (note the plural) for improvements which will generally be worn out by the present generation.

The speaker is of the opinion that paving bonds of any form should not run for a period exceeding 10 or at most 15 years. True, some pavements have lasted and will continue to last for longer periods, with moderate repairs, and no pavement should be adopted which has not a reasonable estimate, *based on practical experience* and results, of such endurance under moderate traffic conditions. In every scheme of finance, however, conservatism demands that culmination of payment should be before rather than after the product of the loan is dissipated.

In the 1917 paper above referred to, the speaker gave our late conservative, constructive friend and President, Nelson P. Lewis, as authority for the following statement:

"New York has many miles of streets which have been reconstructed two and sometimes three times from the proceeds of long-time bond issues, before the first bond issues have been paid."

New York State is continually expending vast sums in reconstruction of roads laid within the past 10 to 15 or less years from the proceeds of 50 year bond issues. That is "letting the next generation pay" with a vengeance.

While citing New York City and State as examples, they are only samples, for many other Municipalities and States are in more or less the same situation.

There is, however, one advantage in Muincipal Bond issues and that is they can be secured under the Municipal credit at lowest rate of interest and the contractor is paid (as he always should be paid) in monthly estimates as work progresses. In other words, the contractor should be engaged on the basis of his experience and reliability as a contractor—not as a financier. However, as will be shown below, these financial advantages can, in most cases, be secured in connection with improvements paid for by assessments.

District Assessments

This plan is working out successfully in a number of States. Arkansas, for instance, where improvement districts are created, generally by appointment of a "District Improvement Commission," consisting of three taxpayers in the District, through a petition filed by property owners with the City Council. The Commissioners apointed have full authority to engage engineers and attorneys; make improvement contracts and issue District Bonds for the paving of all streets in the district designated in the petition filed with the City Council. Generally, these bonds are payable semi-anually from one to ten years and are met by corresponding one to ten-year serial assessments. These assessments against abutters are collected by City Collector and the proceeds turned over to District Commissioners previous to due date of the serial bonds. This system has an advantage of local taxpayers' supervision, as well as better salability of securities than generally prevails in cases of assessments against individual properties, as the bonds are a lien against all of the property in this District. The total cost of the improvement cannot exceed 50 per cent of the assessed valuation of all the property in the District.

Abutters' Assessments

This is the system most generally in vogue in cities throughout the country. In New York City, Boston and some of the older cities, it applies as to the "first pavement," but as most of the streets of these older cities were paved with now antiquated types, including macadam, it means that modern pavements, consisting of renewals, are at the expense of the City at large and quite a burden on finance, as well as limitation of modernizing the paving. Furthermore, the tendency of this provision in connection with new streets is toward property owners selecting or urging cheap and inadequate types of pavement in the hope that when worn out in a few years, the City will modernly renew at its expense. However, in recent years, there has been considerable improvement in this respect, both through official assistance that "first pavement" shall be of adequate, modern type and growing realization of taxpayers that true economy demands high type pavement at first and that when a cheap inferior pavement wears out, the City may not be able or willing to expend its limited funds on that particular street.

Generally speaking, the basis of "Special Assessment" is to assess abutters for the whole or some portion; (usually not less than two-thirds of the total cost of

oroginal pavement, renewals, resurfacing and minor repairs, in the meantime, to be paid for by the City at large from its Street Maintenance Fund.

Usually, the abutter is given option to pay in cash or in anual installments (seldom less than five nor more than ten years) with a reasonable interest rate. The City issues paper for deferred payments, which paper is variously called "Tax Bills"; "Assessment Bonds"; "Improvement Bonds"; "Assessment Certificates," etc. In some cases, the City guarantees the paper, thus enabling it to sell direct to financial institutions at low interest rates. Then becoming a "General Obligation" of the City, the paper can be sold as such under the City's credit at the lowest possible interest rate and the contractor paid in cash on monthly estimates.

The municipalities of Oregon pay for paving by issuing to the contractor upon completion of the work, a tax bill for each piece of property improved, showing the total amount of the tax and which is payable in full within thirty days. Within the thirty day period, the property owner may go to the City Hall and pay his tax in full or sign a waiver agreeing to the amount of assessment and agreeing to pay the assessment with interest in ten annual installments. After the thirty day period has expired, the City then issues and sells its direct obligation bonds in even denominations, maturing serially, from one to ten years, to cover the amount of the assessments where the property owners have signed the waiver and applied to have the property bonded. These bonds usually bear about 1 per cent per annum less interest than is charged by the City to the abutting property and under normal conditions they sell at a premium. The additional interest from the property owners and the premium usually pay more than the cost of the clerical work assumed by the City in printing the bonds and collecting the assessments when due. Property owners who do not pay their tax bills within the thirty day period or apply to have their assessments bonded, are subject to immediate foreclosure of their property for the payment of the tax bill, this procedure being handled by the City in behalf of the contractor. As soon as the property has been bonded or the assessments paid, the contractor can collect from the City Treasury, the principal and interest of the tax bill. There is a provision that the City will not bond any piece of property for more than 60 per cent of its assessed valuation, so that the City takes practically no risk in the issuance of the direct obligation bonds, as they are amply secured by property values and by the waiver of the property owners from contesting the assessment for any cause. These bonds are not considered a part of the net debt of the City under the law limiting the City's bonded indebtedness. The City merely lends its credit with full security. Financial institutions, *knowing in advance* that the "Assessment Bonds" will be taken up in a month or two by the City at par, readily advance to responsible contractors, the necessary construction funds, with the "Assessment Bonds" or contractor's pledge to deliver them when received. This works *well.*

In far too many States, however, the cities issue their "Assessment Bonds" to the contractor in odd amounts, corresponding with amount of assessment against each parcel of land. For instance, assessments for the same project may range from $94.53 to $756.24, payable in ten anual installments, for which coupons are attached and another set of coupons attached to cover semi-annual interest, which interest coupons on the same basis of variation, range from say $2.70 and $22.50 for the first year to $0.27 and $2.25 for the last year. "*Absolutely as good as wheat*" in security, and with a very satisfactory interest rate, the average investor does not want return of his investment in such driblets and odd amounts. Consequently, the contractor to whom the securities are issued is left to "work out his own salvation," which generally means sell to brokers, of which there are comparatively few who have a clientele which will disregard inconvenience of form in consideration of the increased yield, for which broker and final investor demand and receive a considerable discount for paper which is "gilt edge" as far as security is concerned. Of course in the end, the taxpayers pay for this inconvenience in form and salability of securities.

Special Assessment Bonds, which are not a direct obligation of the City, are generally considered to be a less safe form of investment than a bond which is a direct obligation of the City. This is because the legal plan of procedure to levy special assessments is more intricate than that usually required for a general bond issue. It should be constantly borne in mind that if the property values behind the Special Assessment

Bonds are sound and if all of the provisions of law in letting the contract have been carried out, the Special Assessment Bonds may really be better secured than the general obligation of the particular City. The fact that there is no adequate demand for Special Assessment Bonds makes is customary to have the interest rate several points higher than could be secured by the City on its general bonds and this increased cost is of course a burden on the taxpayer.

Experience in several western States has shown that there is often delay in the collection by the City of annual installments due on account of the bonds issued, and unless a fund is created to take care of the interest coupons and the annual payments on the principal, the City's credit is often seriously injured and the selling price of future bond issues is affected against the taxpayers' interests, and steps should be taken to avoid this result.

Recommendations

In conclusion, the speaker, in the best interest of all concerned, pleads for more sane finance and laws with respect to street pavements along the following lines:

1. Assess cost of all pavements, resurfacing and renewals (or at least the greater percentage of cost) against the abutting property which is directly benefited by the improvement.

2. At option of each abutter, exercised within a month of completion of assessment, permit payment of whole assessment in cash or in say 10 anual installents with interest.

3. At the expiration of one-month option period, the City issue its "General Obligation Bonds" in round sum pieces (say $100, $500, and $1,000) with interest at as low a rate as will insure sale of bonds at not less than par. The terms of bonds to be serial coincident with time of due dates of assessment.

4. A law providing that such "Improvement Bonds," being secured by assessments against abutting property worth many times the assessments, shall be not included against the limit of bonded indebtedness provided by law. This on the same priciple that Water Works and other bonds issued against property, having a direct salable and income-bearing value, are exempted or deducted from total liability in determining the amount of net liability to which the legal limit is fixed by law—generally a certain percentage of assessed valuation.

5. For the purpose of most economic contract, the City issues its temporary notes or bonds, from the proceeds of which the contractors will be paid in cash on monthly estimates, leaving them in the position of contractors, rather than contractor-financiers.

6. Make it absolutely obligatory upon the municipalities to foreclose immediately upon delinquency of one installment.

7. Provide for the setting aside by the City out of its general fund, a fund to be known as a revolving fund to take care of delinquent assessments on local improvement bonds.

8. Provide a section in the code dealing with the sale of property by the County for delinquent taxes so that the City must at the time of the sale protect all liens against the property including the street improvement taxes which may have been issued and for which the property to be sold is liable.

The speaker believes that along this line is the one way that cities can generally modernize their pavements to meet the public demand and on the basis of least cost to the City and abutting taxpayers and the least annoyance and expense to all concerned. It will be noted that such a plan has the following advantages.

(a) Only limit of improvement available is the number of abutting taxpayers who are required to pay the cost of improvements and who generally welcome this economic improvement of their properties.

(b) Every taxpayer having an immediate or prospective financial interest, keeps himself well informed regarding pavements, with a maximum of intelligence in action as to types and time for improvement.

(c) Lowest practicable cost consistent with first class improvement.

(d) In so far as this system in more or less modified form has been adopted, we have the best paved cities in the country. Portland, Oregon, for instance, had practically no paved streets in 1902, and in the succeeding fifteen years practically every street in the City was well paved and the demand for modern pavements in that rapidly growing city has become such that the first action of managers of real estate addition is to provide streets and pavements, and of course, sewer, water and gas and then proceed to sell lots which "go like hot

cakes" if paved, but "no sale" if not paved.

Utica, N. Y., in 1886, had but one paved street and with a limit of $150,000 per annum, of which the City at large paid $50,000 from its Tax Budget and assessed $100,000 against abutters (with deferred option installments of one to six years at 6% interest) in the succeeding fifteen years paved practically all of its streets and is now resurfacing pavements laid fifteen years or more ago and is also paving new streets as fast as they are laid out.

In making the foregoing recommendations for general municipal consideration, it is recognized that it is not easy to change an old custom and system which has been in vogue for generations. For instance, taxpayers living in a city where pavements in the past have been paid for from the "public crib" but who have had no pavement in front of their properties, at first glance are apt not to see justice in a change to abutters' assessment basis. However, even such changes have been made in the past and worked well and it is generally possible to educate the taxpayers to see that what is best for the greatest number, is best for the individual and that while the change contemplates special assessments, it also contemplates more prompt improvement, which is of greater importance and a reduction in general taxes to the extent that the cost is shifted from a general burden to the property which is directly improved—usually many times in excess of its cost.

The foregoing paper by Mr. Warren was read at the 1925 meeting of the American Society for Municipal Improvements, at Des Moines, Iowa.

ECONOMY SHOULD GOVERN SELECTION OF HIGHWAY TYPES

By William H. Connell, Engineering Executive, Pennsylvania Department of Highways, State House, Harrisburg, Pa.

The Pennsylvania department of highways is operating on the principle that the selection of types of construction to be used should be based on economic principles.

The primary consideration must always be the probable future traffic and the character of this traffic. Present traffic information is helpful, but often misleading.

The studies being made take into account the probable future development of agricultural, mining, industrial, resort, etc., sections tributary to the respective roads.

It is the purpose of the department to select the economic pavement in each instance suitable for the varying traffic conditions. The economic pavement for each situation must be designed with a view to being sufficiently durable to take care of the estimated future traffic.

Construction based on estimated future traffic information, such as is being developed from studies being made in this state, is far better than selections which are based on using a construction of uniform strength for all traffic conditions.

Five Classes of Pavement

Based on these fundamental principles, the department has adopted three classes of concrete pavement and two general classes of bituminous pavement on a concrete base. These pavements are of a different design than formerly used and are results of experiments and studies that have been carried on throughout the United States. Briefly, the new design for concrete pavement for the three classes is as follows:

First, or class A design for concrete pavement for heavy truck traffic. This pavement will be 10 ins. at the sides, tapering toward the center to a thickness of 7 ins. 4 ft. from the edge. It will be built with a longitudinal joint and reinforced with steel bars either side of the longitudinal joint. It will also be reinforced with longitudinal steel bars 4 ins. and 8 ins. from the edge of the pavement on either side, making a total of six longitudinal bars in the width of the pavement.

Second or class B design for concrete pavement for medium heavy truck and heavy passenger car traffic. This pavement will be the same as class A in every respect, except that the pavement will be 6 ins. thick at the center and 9 ins. at the edges.

Third or class C design for concrete pavement for passenger car traffic and light truck traffic. This design is the same in every respect as class A, except that it will be 5 ins. thick at the center and 9 ins. at the edges.

The following are the designs for the bituminous pavement on a concrete base:

First or class A design for bituminous pavement on a concrete base for passenger traffic and moderate amount of truck traffic. The concrete base is 6 ins. at the center and 8 ins. at the sides for a dis-

tance of 2 ft. from the edges. There will not be any longitudinal reinforcing bars in this concrete base. The wearing surface of this pavement will consist of a regular standard sheet asphalt surface or best type of bituminous concrete surface, both to conform to the standard specifications of the state department of highways.

Second or class B design for bituminous pavement on a concrete base for passenger car and light truck traffic. This design is the same as class A bituminous design, except that the concrete base is 5 ins. at the center and 7 ins. at the edges.

Traffic Line Arranged

Provision has also been made in the construction for a permanent traffic line on curves, etc., 4 ins. in width, made of a white cement aggregate, to be constructed with the concrete pavements and a concrete aggregate for traffic line to be included with the bituminous pavement construction.

These pavement designs will replace the former concrete pavement designs, which consisted of a pavement 8 ins. thick at the center and tapering to 6 ins. at the edges, and 7 ins. thick at the center and tapering to 5 ins. at the edges. These pavements were reinforced with what is known as a mesh reinforcing over the entire width of the pavement.

The longitudinal joint, which has been generally accepted and which is used in the new design, will prevent longitudinal cracks and it is felt that the steel longitudinal reinforcing bars will tend to prevent transverse cracks.

The new designs of concrete pavement can be constructed at a cost of more than $4,000 less a mile than the designs they replace. For instance, the concrete pavement designs that will be most generally applicable to the present needs in highway construction in Pennsylvania will be the pavement 6 ins. thick at the center and 9 ins. thick at the edges and 5 ins. thick at the center and 8 ins. thick at the edges, and while these pavements are placed in competition with a bituminous pavement on a concrete foundation, as a general rule the lowest price is submitted on the concrete pavement type.

Large Sum Saved

Based on a saving of $4,000 per mile and an estimated program of 2,500 miles of authorized construction of this type in the next six years, the saving would amount to $10,000,000. This would enable the department to construct 200 miles more pavement than would have been possible with the former design.

The heavier concrete pavement design for the heavy truck traffic and the lighter design for the traffic where the trucking is very light will be used less extensively than the design 6 ins. at the center and 9 ins. at the edge.

The department of highways will continue during this administration to devote a great deal of attention to intensive studies relating to traffic and pavement design.

While the pavements are probably the most important of the construction projects under the supervision of the department of highways, there are other phases of the work that are important. The elimination of grade crossings, for example, is as serious as any problem the department has to cope with. There are about 1200 grade crossings on the state highway system. The average cost for elimination of a grade crossing is about $75,000. This means an expenditure close to $100,000,000 to eliminate all the grade crossings. The cost of elimination is divided between the railroads, the state, the counties and the townships, the state and the railroads bearing the principal portion.

Grade Crossings To Be Removed

The plans of the present administration contemplate the removal of 150 grade crossings, of which 50 have already been removed.

Another big problem is the provision for new and the replacement of existing bridges. These vary in length from 10 ft. to several hundred feet. They must all be built to carry heavy trucking traffic. Most of them are of concrete construction. During 1923 there were 203 bridges built on the highway system with a total length of 7,726 ft. at a cost of approximately $1,500,000. The construction of bridges alone on the highway system will amount to over $4,000,000 during the present administration.

The construction of durable type pavements is not confined alone to construction of pavements on earth roads. There are over 3,500 miles of stone roads on the state highway system.

The present administration has planned to replace about 100 miles a year of stone roads with a more durable type of construction—reinforced concrete where heavy trucking is an important factor and a reinforced concrete or other pavement on a concrete base where there is not any appreciable amount of heavy truck traffic.

EXPERIMENTAL PAVEMENTS IN BORO OF QUEENS, NEW YORK CITY

By E. E. Butterfield, in Charge of Laboratories, Office of the President of the Boro of Queens, City of New York

(Editor's Note: The following paper by Mr. Butterfield was read at the 1925 meeting, at Des Moines, Iowa, of the American Society for Municipal Improvements.)

At the 1920 Convention of the American Society for Municipal Improvements I presented a description of a series of experimental pavements planned by Mr. Fred H. Shepheard, our Engineer of Maintenance, and myself, and executed by Mr. Shepheard's maintenance forces. The more conservative members of the Society evinced considerable interest in some of the experiments and said, "let us know how these pavements stand up after five years of service." All of the pavements described have now been in service for from five to six years, and one of the experiments has become a standard method of treating dirt roads in the Boro of Queens.

The Boro of Queens is the largest boro of the City of New York. The total area of the City of New York is 314.75 square miles, of which the Boro of Queens occupies 117 square miles. The total mileage of streets in the Boro of Queens is between 1,600 and 1,700 miles, of which 529.75 miles were paved up to January 1, 1925. It is difficult to keep track of the exact total mileage on account of the numerous streets cut through each year during a building boom which has been in progress for five years. The mileage of dirt roads is the figure which is uncertain; it is somewhere between 1,000 and 1,200 miles. The pavements, exclusive of the railroad area, are classified as follows:

Type of Pavement	*Miles*
Sheet Asphalt	108.54
Asphaltic Concrete	104.72
Bituminous Macadam	79.33
Asphalt Block	25.02
Granite Block on Concrete	21.16
Granite Block on Sand	18.59
Belgian Block	2.92
Brick	8.79
Wood Block	7.09
Concrete	7.02
Gravel	1.12
Water-Bound Macadam	145.45
Dirt Roads (approximate)	1,200.00
Dirt Roads, Cinder Surfaced and Oiled	104.31

Surfacing Dirt Roads with Cinders and Asphaltic Oil

In 1920 Mr. Shepheard and I described a method of treating dirt roads with cinders and asphaltic oil for cold application. Since then we have treated 104.31 miles of dirt roads by this method with extremely satisfactory results. The method is briefly as follows:

"The earth road is honed and shaped with a tractor and road machine. The cinders, spread by laborers with coal scoops to an average thickness of 4 to 6 inches, are then slightly compacted by a short rolling with a 10-ton roller. Asphaltic oil is next applied cold from a gravity distributer at the rate of 1/4 to 1/5 gal. per sq. yd. and the roadway is given a final and thorough rolling with the 10-ton roller."

The treatment is used on cross streets between main arteries and on side streets. The appearance and initial stability are excellent. Under the most unfavorable conditions of a severe winter followed by a spring thaw and rains, with a moderate amount of truck traffic from moving vans and building material trucks, the surface will remain intact for at least one year. Under less severe conditions of weather and little or no trucking traffic some of the dirt roads so treated have required no further treatment in five years. If the surface mushes up at the sides and pot holes under the unfavorable weather and traffic conditions it may be easily repaired in the spring at a small fraction of the cost of the initial treatment. The cost of the initial treatment varies from $0.25 to $0.27 per square yard, including all materials and labor.

Bituminous Macadam with Different Kinds of Mineral Aggregate

Time was when trap rock was used exclusively for macadam construction in the Boro of Queens. The acquisition of the nearest large trap rock deposits on the Hudson River by the State Park Commission, forced us to look to other materials for the maintenance of our macadam pavements. In the past six years we have used trap rock, limestone and crushed gravel with apparently the same results under the same conditions of exposure and traffic. Through necessity rather than volition we decided to adopt the working hypothesis that in a bituminous mixture like in a concrete mix-

ture the properties of the resulting mass depended only slightly on the nature of the inert mineral aggregate. The bond between the mineral aggregate and either the asphaltic cement or Portland cement is far weaker than the strength of the mineral aggregates. None of the aggregates used could be called soft or inferior, each type of aggregate having a toughness (impact test) over 8 and a French coefficient of wear (abrasion test) over 8. As our results with limestone have generally been as good as the results with trap rock the only experiment was in the use of crushed gravel and even this has given good results. All of our results on bituminous macadam are based on maintenance work in the upkeep of water-bound macadam pavements according to the following method:

"The old macadam roadway was scarified, reshaped, and covered with 1½-in. aggregate sufficient to make the total depth of 1½-in. material 6 ins. after rolling. When crushed stone was used a course of ¾-in. stone was spread on top of the 1½-in. stone. When crushed gravel was used no ¾-in. material was used because the 1½-in. gravel was sufficiently compact and close without the addition of intermediate material. The surface was sprinkled with sand and then rolled. The bituminous macadam binder previously described was then applied at the rate of 1½ to 1¾ gals. per sq. yd. The surface was then covered with a mixture of material of the same nature corresponding in general grading requirements to broken-stone screenings, 1 cu. yd. of material covering from 24 to 32 yds. of roadway. No seal coat was applied. The bitumen is gradually drawn to the surface by the heat of the sun and capillarity."

It must be noted, however, that our bituminous macadam with either trap rock, limestone or crushed gravel, as mineral aggregate has not stood up under a procession of trucks loaded with building materials. The bituminous macadam pavements in the direct path of extensive building operations have been pretty well pounded to pieces. Under moderate conditions of traffic they have given good service. In a street in which crushed gravel aggregate was used in 1920 there has not been one cent of maintenance expense in six years.

Asphaltic Concrete

The same considerations with regard to the mineral aggregate seem to apply to asphaltic concrete. Owing to the difficulties inherent in the specificiations for Topeka mix we do not use Topeka specifications on new work any more, sheet asphalt top and binder course having replaced the Topeka mix entirely on new work. But we still have a large yardage of asphaltic concrete to maintain. In a street paved in 1920 with Topeka mix using crushed gravel from ½-in. downwards as mineral aggregate, there has been no maintenance cost and the only replacements to the surface have been for cuts for house connections.

Key Block Pavement

This is a freak pavement but one of considerable merit. It consists of:

"Alternating courses of wood and granite block laid at right angles to the direction of traffic. The unique feature is an oak block of wedge or key-stone shape, 4x5 ins. on the wearing surface, tapering at the sides to a width which is ½ to 1 in. less at the bottom than that of the wearing surface; the depth is about 4 ins. Courses of granite blocks are first laid with a space of 3½ to 3¾ ins. between the courses. The transverse spaces are then partly filled with sand and the keys are then firmly rammed in between the rows of granite block. The result is a series of alternating courses of granite with oak blocks tightly wedged between them. This type of construction has been used extensively for the past seven years in the franchise area of the New York Railways Company, particularly at street intersections which are subjected to unusually heavy traffic. It is essentially an economical method of repairing or repaving a worn granite-block pavement to meet conditions of excessively heavy traffic. As the oak blocks project slightly above the level of the granite the wood consequently bears the brunt of the traffic and the harder the oak blocks are pounded by traffic the tighter they should become wedged in, thereby increasing the stability of the whole pavement."

In June, 1919, we replaced a badly cobbled Belgian block pavement on a macadam base with the key-block pavement. There was immediate relief from noise and slipperiness and although the pavement has been subjected to heavy crossboro traffic for six years the expense of repairs has been about $100 on three city blocks of pavement on which the only drainage is surface drainage. Some of the oak blocks not coated with asphaltic grout have rotted in six years, blocks still pro-

tected by bituminous mastic are in good condition.

Paving with Rectangular Hard Wood (White Oak Blocks)

Owing to the density and toughness of white oak and its low water absorption we have tried untreated oak blocks for repairs to creosoted pine pavement. For repairs they do not seem to offer an advantage. The Boro of Manhattan, however, has laid under contract a stretch on Second Avenue, in which rectangular white oak blocks were used with a seal coat of bituminous grout underneath the blocks and on the surface of the pavement, which is standing up well after three years of service.

It is gratifying to report that all of our experiments have given good service for from five to six years. The cinder and asphaltic oil surfacing of dirt roads has passed the experimental stage and has become a part of our regular maintenance program. The other experiments have all stood up as well as our regular contract work done under standard specifications. Resurfacing badly worn granite block by means of alternating courses of oak key blocks offers a method of reducing the noise and slipperiness of a pre-existing granite block pavement at a cost about the same as reclipping, renewing and replacing an entire granite block pavement.

THE SALVAGE VALUE OF BRICK PAVEMENTS

By A. S. Mirick, Eastern Paving Brick Manufacturers' Association, Pittsburgh, Pa.

(Editor's Note: The following paper was presented at the 1925 meeting, at Des Moines, Iowa, of the American Society for Municipal Improvements.)

Fifty-five years ago the first brick pavement on this side of the Atlantic was laid in Charleston, West Virginia. The experiment proved a success. Thus from a small beginning, the use of brick for paving purposes spread rapidly. Meanwhile, the industries of the United States were developing amazingly; gigantic steel mills were being built, the coal and coke industries were developing, and hundreds of large manufacturing projects were started on a mammoth scale. Industrial towns were springing to light all through the East, while the older cities and towns were expanding at an undreamed-of rate. Naturally, the urge for paved streets was very great. It was necessary that the pavement should stand up under rough usage, and that it should be laid quickly, without special equipment, and at a low cost. Brick block seemed to meet these requirements, and for nearly three decades after its introduction was almost universally used in the sections of the country where brick could be produced at an advantage.

Most of the brick paving laid previous to 1900 was either laid upon the soil direct, or upon a gravel, stone, cinder or slag base. The sand cushion was often 3 ins. in depth, the paving usually consisted of a brick block 2 ins. in width, 8 ins. in length, and 4 ins. in depth. The joints were usually filled with sand. It is remarkable, however, how well these old pavements have stood up under modern traffic. Many service cuts, poor drainage and poor foundations have made them rough and unsightly, and they are being replaced with new pavements, designed to carry our present and future traffic.

As these venerable pavements are being replaced and the old brick is taken up, it is generally found that the brick show very little wear. Hence the question arises, what shall we do with these brick? It is the purpose of this paper to show how the officials of some of our cities have answered this question.

In the fall of 1923, Monongahela City, Pa., decided to pave its "Main Street." This street had been paved with small brick, laid upon a gravel base. It was originally built in the early nineties, and had become rough and uneven during the intervening years. The old brick when taken up, were found to be in excellent condition, and the city engineer told me that the city had been offered more for these old paving brick than they originally cost, some thirty years before. Naturally, this surprised the city engineer, and he reasoned that if these bricks were worth that much to outside parties, they must be worth at least that, and more, to the city; so he stored them and is using them for alley paving, manholes, brick gutters, etc.

In Corry, Pa., a few years ago the engineer had occasion to repave an old brick street. The brick when taken up were found to be quite worn, and unsuitable for paving. The engineer stated, however, that they were worth the price of common brick to him, as he could use them in a fire house he was constructing.

At Grafton, W. Va., the business section of the city was entirely repaved. It

had been originally paved in the nineties with small brick, laid 4 in. in depth. The original pavement was on a light gravel base, so that in the course of time it became rough. The old brick showed very little wear, consequently they were eagerly seized upon by the abutting property owners for sidewalks. The brick were laid flat-wise and grouted with cement. When finished, these sidewalks were very smooth, and presented a pleasing appearance. They also used the old block to pave between the rails of the street car track. The tracks were of a section that would not allow the use of a 3 in. brick, so the engineer allowed them to use the old brick laid flat-wise. These brick were 2½ ins. in depth, and this made, in effect, a vertical fiber brick pavement. The brick were so little worn that they served the purpose nearly as well as new material; 462,000 of these brick were used to pave Yates Avenue. They were laid edgewise, upon a concrete base, and grouted with cement and sand; 80% of the brick were salvaged. The results obtained were first-class in every respect. The cost to the city for the brick surface was only the cost of cleaning the brick, which was 10 cts. per square yard.

The most common way to salvage old brick pavements is to turn and use the brick as a wearing surface upon a new foundation. Many engineers have done this successfully, and I will relate some of the experiences that have come under my personal observation.

A typical experience of relaying old brick is given by Mr. F. M. Harper, City Engineer of Butler, Pa. Mr. Harper, in a letter on this subject, states the following:

"Thinking it may be of interest to you, I am submitting a short history of some repaving done on North Main Street, in the City of Butler, Pa., by day labor, under the direction of the Engineering Department, during the summer of 1923.

"This street is a part of the paved highway leading to Erie, Cleveland, and Buffalo, and is subject to very heavy traffic. I feel safe in saying that during the summer months we have an average of 200 cars per hour, ten hours per day, and have been informed by the police that it has reached 800 cars per hour on holidays and Sundays.

"The above mentioned street was constructed during the years of 1891 and 1892, under the specifications which called for 9 ins. of natural stone base, 1 in. of sandstone, natural sandstone curb, subdrained by 6 ins, of crushed stone, vitrified wire-cut brick, and pitch filler. As I was quite young when this work was done, I am not familiar with the construction of this pavement, but have since learned from men who worked on street, that the stone used in the base were strippings from a stone quarry where the curbing was procured, therefore contained quite an amount of loam; also that the sand used for the bed or cushion was for in the specification, they used as much as 2 to 3½ in., which was revealed when we removed the brick.

"During the winter of 1923 we had continuous rain for about a week, which ended by the temperature dropping to zero in 24 hours. This cold continued for about four weeks during February, driving the frost down through the base of the street into the sub-drain, all of which was saturated with water. About March 1 the weather condition changed suddenly, causing a surface thaw, and freeing water held in the 3 in. loam cushion. As the sub-drainage was closed by the frost, the water could not be carried away from the loam, and converted it into a slippery muck; then, when the traffic passed over it, it caused the pavement to upheave. As the weather conditions were not favorable for permanent repair, the brick were removed and the holes filled with fine slag, in order to keep the street open. This condition did not exist the entire length or width of the street, but was at intervals so close that from an economic standpoint it required repaving.

"On examination, I was surprised to find that the brick were not worn to any great extent, notwithstanding their 32 years of use, so it was decided to use the best of them in the reconstruction work.

"The labor conditions in the spring were quite serious, therefore the question of cleaning the old brick had to be considered. To overcome this, I contracted with schoolboys during the summer vacation to do this cleaning at the rate of $5 per M. for removing, cleaning, and piling the brick along the curb. I might state that this worked out very well, giving employment to the boys, who made from $2 to $3 a day, and saving the city from $3 to $4 per M.

"The old sand cushion was removed by means of a road machine and tractor, leaving the crushed stone base. This

was replaced and brought up to the proper height with crushed slag and the use of a templet. It was then rolled thoroughly with an 8-ton roller, which settled it about one-half to one inch, on which was placed ⅝-in. to dust limestone or slag screenings to form the bed for the brick. The brick were then turned, laid, rolled and pitched in the usual way, forming as smooth a surface as though we had used new brick.

"On completion, the measurements showed we had removed 4,713 sq. yds., of which 4,083 yds. were relaid with old brick which had been in use for 32 years, at a cost of $1.26 per sq. yd., and 630 sq. yds. of new repressed block at $2.75 per sq. yd., both prices including pitch filler.

"The foregoing method of construction, as recommended by the Engineering Department, met with considerable opposition from contractors, who, of course, advocated complete new construction, which on a similar job, was bid at $4.05 per sq. yd., thus saving the city approximately $12,000. The work as completed, after having sustained the abnormal traffic of 1923, and several freezes and thaws of 1924, has all appearance of being of a quality of new construction."

Johnstown, Pa., recently repaved Johnstoneycreek Street. This street was originally paved in 1907 with standard paving block upon a slag base. When the old brick were taken up, it was found that 92 per cent were suitable for the new pavement, the other 8 per cent were used by the city for patchwork. In this case the old brick were excavated and cleaned, a new base 8 ins. in depth was constructed, the brick were then turned and relaid on a sand cushion 1 in. thick, the joints of the brick being filled with asphalt. The entire cost of the new pavement was $3 per square yard.

Wheeling, West Virginia, also reconstructed several streets in a like manner, the old brick were taken up, cleaned, and piled, a concrete base constructed, the brick relaid, best side up, the joints were filled with asphalt. The cost at Wheeling was $2.40 per sq. yd. for a concrete base, 5 ins. thick, relaying the brick complete with sand cushion, and $2.70 per sq. yd. where the base was 7 ins. thick. The cost of filling the joints with asphalt was about 30c a sq. yd. Here, as in Johnstown, the cost was about $2 less a square yard than if new brick were used. When in Wheeling a short time ago, I was given some interesting figures regarding the paving of Alley E, with old brick taken from Main Street. This alley, 647 ft. long, cost $448 to pave, or about 34 cts. per running foot to the property owners. The brick was laid on a cinder base and the points filled with sand. There are many alleys in Wheeling that have been similarly paved with salvaged brick.

Wilkinsburg, Pa., has also made a practice of reconstructing its old brick pavements by relaying the brick on a suitable base. It has also used old brick (taken from the streets that have been repaved) for alley paving. This work was done usually with the city's own force, and with unusually good results. Other cities, such as Tonawanda, N. Y.; St. Petersburg, Fla.; Vicksburg, Miss.; Lynchburg, Va.; Bucyrus, Ohio; Meridian, Miss., have reconstructed their brick streets, salvaged the brick, and relaid them with great success, and at a great saving to the taxpayers. There are many other ways in which salvaged paving brick can be utilized in city and township work. Every official who has anything to do with construction work knows that a pile of salvaged paving brick bears about the same relation to street patchwork as hay wire does to the Ford. It is the handiest and most effective material for emergency repairs. Seldom do you see a service cut or other opening made in the street pavement but that it is usually rough-paved with brick, until permanent repairs can be made. This is the hardest service to which any material can be subjected, therefore a stock of slightly worn, salvaged paving brick is just the thing for the temporary repairs.

It will be many decades before the question of the salvage value of the modern designed brick pavement becomes one of sufficient importance for discussion; but when the subject of reconstruction of the pavements that carried the marching clubs of the Blaine and Logan campaign, the circus parades of Barnum & Bailey, and the triumphal return of the Spanish-American soldiers are contemplated, it is wise to consider the salvage value of the brick that composed them. Every block that can be used again, either for reconstruction or on the other streets means that the tax dollar will do double work, and the number of new paved streets will be doubled.

THE MAINTENANCE OF ASPHALT PAVEMENTS

By Hugh W. Skidmore, Chicago Paving Laboratory, Inc., 536 Lake Shore Drive, Chicago, Ill.

(Paper presented at the Fourth Asphalt Paving Conference, Detroit, Mich., Oct. 21-23, 1925.)

Like most things which are honestly worth their initial cost, asphalt pavements deserve intelligent care in the matter of repairs. Too frequently they are not accorded this consideration, especially in some of the smaller communities, and often, even in our large cities. It is a common fault among municipal administrations to assume that once the pavement is constructed it may be forgotten indefinitely. In part, at least, this may be explained by the fact that our American system of politics brings about rather frequent changes in the personnel of those in whose care our municipal affairs are placed on many instances one group of officials hardly becomes familiar with the routine of public affairs before they are displaced by an entirely new group.

Passing quickly by the reasons for negligent maintenance of municipal investments, especially pavements, and even more particularly asphalt pavements, the fact remains that they are not generally kept in as good repair as they should be, and in fact as can be with very little expense to the taxpayers. None of us will question the statement that a reasonably well built asphalt pavement, reasonably well suited to the traffic requirements, will cost much less to maintain over the period of its normal life than the expense of reconstruction, because its normal expectancy has been reached. This, I believe, may be accounted an economic fundamental.

This text, then, will be given over, not to lamenting the fact that our pavements are not maintained as they deserve, but more constructively, to an endeavor to indicate how they may be kept in good condition as economically as possible. A great moral in this direction is embodied in the epigrammatic admonition "Don't permit the little holes to become big ones."

Undoubtedly the greatest enemy of pavements is the poorly repaired service cut. The line of least resistance is, of course, to permit the maker of a pavement opening to repair it in more or less his own fashion. The proper method, on the other hand, will require considerable attention on the part of some municipal department, preferably the Engineering Department. The first method means early ruin to the pavement, while the second, at least, means minimizing as much as possible the harm of service cuts. No simpler or more effective scheme seems possible than to require a permit fee sufficiently large to cover cost of replacement plus overhead expense to the City; to require that the excavation be backfilled, the foundation rebuilt and the pavement relaid according to a rigid specification that will provide against settlement of the pavement; all under rigid inspection by the city and at the expense of the firm or individual to whom the permit is issued. That this can be done has been frequently demonstrated—that it more frequently is not done is quite evident to even the casual observer. Poorly maintained service cuts give the town a "slipshod" appearance. If the city is negligent in the enforcement of this important item, it is sure to be equally as careless in its own street repairs and such an attitude on the part of the municipality does not reflect credit upon the engineering department, nor does it encourage the abutting property owners to keep up their lawns and parkways.

The small city is faced with two major problems in the repair of asphalt pavements. The first is the temporary repair which must be immediately installed in order to protect the remainder of the pavement and maintain a smooth traffic floor. The second is the permanent repair, which may be delayed until a fair quantity of such repairs makes the operation of a repair plant reasonably economical. The interim between temporary repairs and permanent will naturally vary, and should likewise control the relative permanency of the temporary repairs. For instance, if repairs are required upon a certain street and it is known that a plant will be operating in the neighborhood in a few days, the surface may be held for this short period with some simple, inexpensive repair such as light penetration with crushed stone or gravel.

It goes without saying, that the permanent repair should be made as soon as possible. Such repairs should never be made by means of penetration or cold patch work. These methods do very well

for temporary maintenance, if the time between the temporary and permanent repairs is not too long, but they will not hold the pavement surface very long under our modern traffic; moreover, they make ugly patches that detract materially from the appearance of the street. Witness the West Park Boulevards in Chicago. Permanent repairs should by all means be made with hot mixture of the same type as the original pavement. The materials used in this work should be as carefully selected, as accurately proportioned and well mixed as a new pavement. For this reason permanent repair work should be in the hands of experienced men.

If the community is large enough and the volume of repair work during the course of the year will warrant, a municipally owned plant of small capacity may be a really economical investment. If, however, the town boasts an asphalt paving contractor, it will usually be found that a better plan is for the city forces to install temparary repairs as needed and employ the local contractor to make permanent repairs. In such situations the contractors are satisfied to do this work at cost or a small profit, and they are wise in such an attitude as it is good advertising for them and they should show some pride in assisting the community to maintain its pavements.

On the other hand if no local contractor is available, the municipal authorities should waste no time in purchasing a plant consistent with their needs. The success of operation of such a plant, large or small, will depend entirely upon delegating the work to someone of fair intelligence, preferably, of course, to someone with experience, if possible, and if this is not possible, the authorities should see to it that such person receives instruction from somebody familiar with the work. Such instruction should be a condition of the purchase of the plant. All such work should be under the supervision of the engineer.

There are a number of small plants on the market that fit almost any requirement and most of them are quite simple of operation. The all important feature of this operation is using good materials in their proper proportions, and above all, avoiding the use of an excess of asphalt. It is frequently the case that such work done by city crews is given very casual supervision, if any at all, and the result is that the laborers are apt to get the notion that if a little asphalt is good, more is better. Patches that are so rich, they shine and distort under traffic are the result. If the volume of work warrants a regular hot mix plant similar to those used by contractors, a special study of the requirements should be made by someone thoroughly familiar with such matters and a definite program outlined. It will be found that a little money spent in this manner will be more than repaid by economical operation later on. Work of this nature should be done under laboratory control.

Repairs will include, in addition to service cuts, broken base causing depressed or ruptured wearing surface, ruts and waves, small disintegrated or ravelled areas and cracks. As is well known, most of the cracks in asphalt pavements are duplications of those in the base, particularly if the base is portland cement concrete. There is but one really satisfactory method of repairing cracks and that is to keep them filled with asphalt cement. The cracks should be cleaned out thoroughly and then blown out with air pressure (this can be done by means of a small air compressor, or cylinders of air under pressure) then the crack poured full of hot asphalt of regular paving consistency. A ridge of asphalt will remain on the surface of the pavement, this should be covered with limestone filler or portland cement while the A. C. is still hot and then ironed in with hot smoothing irons. It will be found that this method is much more satisfactory than the same treatment without the use of filler. All such work should be done in the early spring or fall when the cracks are at maximum width. Mild winter weather is an ideal time for this work. Ravelled areas should be cut out and replaced as soon as noted, before large holes develop. All the brittle or dry material should be removed and a vertical joint cut in good pavement so that a smooth workmanlike patch may be made. If the binder is defective it should also be replaced.

Ruts and waved areas cannot be satisfactorily repaired by either covering them up with surface patches or burning off the top down ½ in. to 1 in. and resurfacing. Such faults are due entirely to defective mixture, and, therefore, the entire affected area of pavement must be replaced with good mixture. In all such cases an analysis of the distorted mixture should be made for study together

with records of the original work and an examination of the foundation and binder. Undue dampness should be noted together with smoothness of base, evidence of slippage of binder and wearing surface, lack of adhesion of top and binder and all other local evidence that might be either causative or resultant with respect to the distorted area of pavement. Replacement of all such defects as distorted pavement should be made with especially dense resistant mixture especially designed for the purpose. All such mixtures should contain a high percentage of filler and well graded aggregate with no excess of bitumen. Excessive bitumen is the chief source of mixture distortion under traffic.

Very successful work of replacing distorted areas has been accomplished by removing the old mixture, crushing it and remixing after adding aggregate which is shown by careful analysis to be satisfactory and economical when intelligently carried out. A few years ago the West Park System in Chicago did some very interesting work of this character.

Broken base should unquestionably be replaced before permanent repairs are made to the surfacing. A very satisfactory method is the use of "black base" for replacement. An especial advantage of this type is that it may be immediately installed and opened to traffic in a few hours instead of waiting for portland cement concrete to cure. It is also very desireable in replacing defective macadam base, without danger of settlement, that might follow subjecting new macadam to traffic. Base cracks (P. C. concrete) which have heaved or buckled can be satisfactorily corrected by cutting out the base for a width of about 12 to 18 in. along the crack and replacing same with "black base." Numerous repairs of this exact nature were made many years ago and have given perfect satisfaction.

Costs of repairs will not be discussed here as they are too dependent upon local conditions, such as materials and management, to afford intelligent generalization.

The principal message of this discourse is that if the pavement is worth its original cost it is worth keeping in repair. Neglect of this important function on the part of officials cannot be excused by even ignorance of proper methods since ample means of suitable information exist. This association can perform an important service to the industry in this direction.

Educational work along these lines should be directed against poor repairs as well as neglect of maintenance. An asphalt pavement which has been carelessly repaired is just as much an "eyesore" as one that hasn't been repaired at all; moreover workmanship of this kind gives the public the impression that it is impossible to satisfactorily repair asphalt pavements, thereby seriously injuring the construction of more asphalt pavement in that particular community.

PROTECTION AGAINST DAMAGE BY EARTHQUAKES

By Prof. C. E. Wing

(Editor's Note: The following paper by Prof. Wing was read at the 1925 meeting of the League of California Municipalities.)

The people of almost every section of the United States are more or less familiar with earthquake shocks and their effects.

Within the last year there have been earthquake disturbances, of greater or less intensity, widely distributed throughout the country, culminating in the recent seriously destructive shock at Santa Barbara.

Within the recollection of the older members of the present generation two other shocks have occurred in the United States of approximately equal intensity—that of Charleston in 1886, and San Francisco in 1906.

That the experiences of the past generation are likely to be repeated in the next cannot be seriously questioned. Where the damage is most likely to occur is more difficult to determine.

The fact that within the past year seismic disturbance has been generally noted in such widely distributed areas as New England, Illinois, Montana and California, would indicate that there are few parts of the United States, if any, that before the end of this century may not be visited by a shock of destructive intensity.

Fortunately, in the past the loss of life by earthquake in the United States has been relatively small.

The danger of such loss in the future will increase with increasing density of population, and the next generation may experience at some place in this country a disaster such as those of Tokio, Messina or Lisbon.

While the facts as stated above are not

to be ignored, neither are they to be taken too seriously.

In addition to earthquake, there will be disasters due to fire, tornado, flood, famine and pestilence, any one of which will probably take a greater toll of life and property in a generation than the most spectacular of earth crust disturbances.

Like the dog afflicted with fleas just so he will not forget he is a dog, human beings will probably continue to be afflicted with earthquakes just so we shall not feel that we are omnipotent.

Recently in looking over an old family bible, the writer ran across the following note on the margin:

"O unhappy Philadelphia and New York in the years 1793 and 1795 did receive a ruinous blow with the malignant or yellow fever, which is sent the second and third time into those cities I fear for want of a timely repentance and amendment of life. * * * * O if the inhabitants of our land would break off their sins and iniquities and sin no more, lest this overflowing scourge under which some of our cities have severely smarted should be commissioned to visit our land throughout."

Judging by recent events, it would not be hard today to secure numerous adherents to a similar propaganda regarding earthquakes.

Of all the so-called "Acts of God" to which human beings are subjected on this restless sphere called earth, earthquakes are perhaps the hardest to foretell and the results most difficult to guard against.

However, the causes of earthquakes are less mysterious to scientifically trained minds today than the causes of yellow fever were to the generation of our great grandfathers, and possibly our great grandchildren may be able to predict the time and place of earthquake shocks with considerable accuracy.

In the meantime, about the best we can do is to assume that somewhere in the United States about every twenty-five or thirty years there will be a municipality that may suffer damage by earthquake to the extent of one-fifth of the value of its improvements, and this earthquake damage to improved property may be increased by subsequent fire loss.

In addition to property damage, there may be a greater or less loss of life.

Anything involving loss of life should be given serious consideration, but there is no justification for becoming hysterical about it. For the average individual, the danger of death from fire is probably many times greater than the danger of death by earthquake.

Nor is a possible average annual loss of a few thousandths of one per cent of the value of the improved property in the United States sufficient justification for insurance companies unduly to increase the rates of earthquake insurance immediately after a destructive earthquake has occurred. Such action is too much like adding insult to injury, unless it can be justified by carefully analyzed statistics based upon thoroughly reliable data.

Perhaps one of the most helpful lines of investigation the seismologists can undertake is the preparation of an earthquake probability map of the United States which could be used by insurance companies to vary equitably the cost of earthquake insurance in different localities.

In this way those regions deemed especially sinful can forestall the effects of a just visitation by paying for the same in advance.

Charging all the traffic will bear as a general policy is no more justified for insurance companies than for transportation companies.

Insurance is possibly just as much a public utility as water, light, power or transportation. Certainly it is the duty of municipal authorities to use every legitimate means to secure just and equitable rates of insurance for their communities and, by co-operation with organizations of underwriters, enact such legislation as is economically justified tending to minimize earthquake damage when destructive shocks occur.

Insurance companies recognize well planned legislation lessening fire hazards by a reduction in rates, and it is believed that they will do the same when efforts are made by municipalities to minimize the chances of loss by earthquake shocks.

Ways and Means

The question naturally arises as to ways and means by which a municipal government can reduce the chances of loss by earthquake.

To discuss the question intelligently requires a brief resume of the kind of damage most likely to occur to city structures.

To begin, it can be assumed as an axiom that given an earthquake strong enough, nothing that man can build will

escape damage, especially if the structure is located on the fault line, movement along which causes the earth vibration.

The so-called San Francisco earthquake of 1906 was caused by a slip along the San Andreas fault. The land on one side of this fault moved north, and that on the other moved south. The maximum movement near Point Arena, on the north was approximately fifteen feet. At this point the fault line disappears in the ocean to the northwest.

The movement extended to the southeast some one hundred miles.

The vibration of the earth adjacent to the fault caused serious earthquake damage to cities within four or five miles of the fault from Santa Rosa on the north to Salinas on the south.

The recent Santa Barbara movement was much more limited in area affected, but, due to the nearness of the city to the center of disturbance, the damage to structures was approximately the same.

While in this day and age one may not be willing to admit that earthquakes are a visitation from God on a community because of its sins, yet surely there is nothing like an earthquake for revealing structural sins of omission and commission.

Structural Susceptibility

Types of structures in the inverse order of their susceptibility to damage by earthquake may be classified as follows:

First, timber frame structures. This class includes most of the dwellings in California communities and, in cities of less than 10,000 population, many of the schools, churches and other public buildings.

Second, structures with masonry walls such as brick, stone, hollow tile, concrete blocks and much reinforced concrete work.

Third, steel frame structures in which the steel is protected by a casing of concrete.

In this class may also be included the best types of reinforced concrete work, but only the best.

In the San Francisco and Santa Barbara earthquakes it may be roughly estimated that over eighty per cent of the economic loss due to the shock was from damage to structures of the second class.

This being the case, the first remedy to suggest itself to a layman would be to legislate against this type of construction.

Economically this is impracticable, because the fire hazard from timber construction in closely built business districts is too great, and the rental value of most of the space in the business district of cities of less than 40,000 population is too low to justify buildings of steel frame construction.

Assuming that in all cities regardless of size there is at present, and economically must continue to be, a large financial investment in buildings constructed of unit masonry, how best can a municipality minimize the danger of economic loss of life from earthquake destruction of buildings of this type?

Causes of Damage

Inspection of an area where the buildings have been destroyed by earthquake gives evidence that the damage has been largely caused by

First. Poor design.

Second. Poor material.

Third. Poor workmanship,

and that where design, material and workmanship are of the best, relatively little damage has been done.

Nearly all cities have adequate laws providing building codes that cover all phases of building construction, but have largely neglected to see that the laws are properly enforced. Failure of law enforcement is perhaps a besetting sin in all American communities, and is why earthquake damage has in some instances been as high as twenty per cent of the value of improvements instead of two per cent.

Of the causes of damage just mentioned, poor workmanship is probably more responsible for loss than either of the others.

In one case known to the writer four public buildings were built to identical plans and specifications; two were badly damaged by earthquake and two were comparatively intact.

Inquiry developed the fact that with the first two the inspection was lax and with the last two the inspection was rigid.

The responsibility for the present unsafe condition of most of the buildings should, in the opinion of the writer, be divided between the owner, builder and designer, with the greatest responsibility on the owner for, after all has been said, it is pressure from the owner that leads the designer to "take a chance," and excessive competition that leads the builder to "bid too low."

Suggested Action

To sum up, two lines of action are suggested.

First. To revise somewhat our present building codes in regard to provision for capacity to withstand the action of lateral forces (so-called wind loads), and possibly to vary such requirements in accordance with the character of soil on which the structure is founded. It is known that structures designed to withstand safely a lateral force of thirty pounds per square foot of vertical elevation have withstood severe earthquake shocks without great damage.

There is abundant evidence that lime mortar does not form an adequate bond for unit masonry construction, nor can such units be held together by cement mortar under earthquake shock, unless the units are saturated with water before laying—not merely wet.

The details of these revisions should be worked out in co-operation with underwriter boards and arrangements made whereby communities strictly adhering to same can receive the benefit of reduced insurance rates.

Second. Exercise the police power to protect life by requiring fees for building permits sufficient to cover the cost of maintaining a bureau of inspection of the department of engineering organized to check all designs and specifications in detail, and provide continuous inspection to see that the same are rigidly enforced without fear or favor.

This is theoretically the organization that most cities have today.

Practically, inspection has been a failure; possibly due to lack of appreciation of the fact that to qualify as an inspector, the applicant must first qualify as a designer. To be a good inspector one must have practical experience, but that does not mean that any one with practical experience will make a good inspector.

It is believed that carrying out these suggestions will increase the stability of the ordinary business building in the average sized town several hundred per cent, without materially increasing the cost.

But to accomplish this result will require the services of trained men with adequate compensation.

JUDGE COLGROVES ADDRESS ON FEDERAL AID

(The following is the address of Judge Phil T. Colgrove delivered at Knoxville, Tenn., during the progress of the Dixie Highway motorcade, which started from Sault Ste. Marie, Mich., October 5, and ended at Jacksonville, Fla. While this address was delivered in full at Knoxville it was delivered wholly or in part at other big meetings during the motorcade. It was also published in the New York Times at the request of the editor of that paper, and given at the Michigan State Road Show, Oct. 28, 1925.)

As one of a small group of men who in the early nineties appeared at the capitol to urge the congress to consider the question of Fderal Aid and the building up of a National System of Highways, I have felt a deep concern in the ultimate outcome of the campaign now being waged in various states urging upon the Congress the discontinuance of this plan.

It is evident from the present outlook that there is a definite movement in the country to do away with Federal Aid for roads. It must be conceded in the outset that this movement very largely comes from sections that have either completed their Federal Aid Systems or practically so, or from a few of the states that pay large Federal taxes due to the fact that corporations doing an international and interstate business have their headquarters in these states.

Maryland and New York are prominent among the states where large corporations have their legal headquarters, and where they pay what may properly be called enormous taxes, growing out of their corporate interests. The situation presents no new problem. In practically every state we find, in a lesser degree, the same objections and the same argument.

In Michigan my attention has been called to various counties who when called upon to pay as a county unit for the construction of highways, we have found that where the east side of the county has practically built and completed their roads they are not willing to become a part of the county unit to construct the roads to be built in the western section of the county. They say, we have built our roads, now you build yours.

So it happens that there are states in the Union which have practically completed their Federal Aid roads and are

now quite willing to join in a movement to suspend the Federal Aid project.

Heavy Corporation Taxes in Some States

The states which are required to pay a large sum into the Federal treasury largely by reason of corporations doing an international and interstate business, and who have their legal headquarters situated in these states, the facts should be known. An illustration has been aptly made by taking the state of Maryland as an example. This is one of the states known as the home or headquarters of large corporate interests.

Maryland paid in corporate and personal income taxes in the year 1922, $22,819,135, and received back in Federal aid but $714,744, or 3.15% of all she paid in. An editorial in one of our magazines recently said that this statement is by no means the whole history. In 1924, Maryland paid even more than in 1922. In 1924 the Federal Government paid 2.3% of its total expenditures for roads, therefore 2.3% of what Maryland paid into the Federal Treasury went for roads. Maryland paid into the Federal Treasury that year, $34,349,218. Of this amount 2.3% went for roads, or $697,203.00. Maryland received from the Federal Treasury that same year $603,527.

This same editorial takes for an illustration the payment of pensions. The Government that same year, or 1924, expended 6½% of every dollar if its income for pensions, therefore, 6½% of every dollar which Maryland paid into the Federal Treasury went for the payment of pensions, which was $2,234,699. It happens that the pensioners in Maryland received that same year, $2,408,022.

That same year, 1924, the Federal Government expended 1.7% of every dollar it received in the development of rivers and harbors. Maryland contributed by the same method, $585,936.00 but the Government on the other hand expended in Maryland, $1,772,677.00 for rivers and harbors.

So it would seem that if we take into consideration this matter by states, Maryland is not suffering, but is on the other hand as the writer says: "Money in pocket."

This illustration might be extended to other states and clearly shows that Federal expenditures and Federal receipts have no connection with state lines. Our people, wherever they live contribute both as individuals and corporations to meet the requirements of the Federal Government, willingly and little fault is found.

It is within common knowledge also that there are states which support our pension system and receive little back in pensions, and many of our people have speculated how and why many states in the Union should contribute towards rivers and harbors where they have neither rivers nor harbors.

These states though their representatives in Congress have taken the larger view and have voted to sustain a system which is for the general good of all states and of all our people.

It is equally true that there are states which pay much more than they receive for the building of our highways, but it must be admitted that this is because of concentration of wealth and in many instances of very small mileage of highways.

Little Opposition in Middle and Western States

So far as my observation goes there is little opposition to the policy of Federal Aid in the middle and western states, and in those states where Federal appropriations have meant the very life and backbone of the State Highway Department.

The movement now on foot to dispense with Federal Aid, attempts to justify its policy on the ground that if justified in the past, it no longer exists because each state has now provided a source of revenue to finance its own highway program. It may also be said that there is a strong sentiment to discontinue the Federal excise tax on automobiles and accessories, that it is a war time measure and should be abolished. In this many of us concur and for the best of reasons.

Excise Taxes Not For Highways

It should be understood in the beginning that the Federal excise tax on automobiles and accessories is not levied to provide Federal Aid, but is paid into the Federal treasury just the same as is other federal taxes, to finance the general expense of the Government. It is generally understood that the amount appropriated by the Congress for highway construction is less than half of the revenue derived from the Federal tax on automobiles and accessories. In other words the Government has received more than half again as much from this source as they have paid for Federal Aid.

We have in this country more than 12,000,000 owners of automobiles, while on the other hand there are but 4,000,000 income tax payers. We are advised that for the fiscal year 1926, there will be a surplus in Federal revenue of be-

tween $350,000,000 and $400,000,000, available for tax reduction. Of this vast amount in the general treasury the automobile manufacturers and owners of automobiles have contributed a vast sum.

It would seem patent to all that a continuation of Federal Aid for highway construction should not be opposed on the ground that the funds are derived wholly from the automobile industry, as they are in no way connected.

To those who have given this subject consideration it seems patent that if the Congress sees fit to bandon the excise tax on automobiles and accessories as a source of Federal revenue, it follows by no means, that Federal Aid for highway construction should be eliminated, any more than any other of the activities of the Government, as Federal Aid for highway construction is paid out of the general treasury of the United States by appropriations made by Congress as provided in the terms of the Federal Aid Act of 1916.

The $75,000,000 annual appropriation is divided among the states in the proportion their area, population and taxable valuation bears to the area, population and taxable valuation of the entire Union.

Taxes on Non-essentials

Mr. J. M. Page in a recent address has said: "In a recent report of the United States Treasury Department appears a list of the estimated expenditures by the people of the United States on various non-essentials such as tobacco, non-alcoholic beverages, theaters, movies, candy, jewelry, perfume, cosmetics, chewing gum, etc., as $8,031,000,000 in 1924.

He says just six months allowance of the above fund would improve the entire Federal system of the United States and enable us to drive from the county seat in any county in any state to the county seat of any county in any other state in the Union and keep on a paved road.

At the time the Congress passed the first law providing for Federal Aid to the states, it was for the purpose to improve the rural roads over which mails were carried and to foster highway construction generally. The whole country was the unit considered so far as roads were concerned. The greatest value derived from the passage of this Act was not only to strengthen the hands of the State Highway Departments already existing, but to cause the creation of State Highway Departments in all the states, and the Act itself provided for the establishment of State Highway Departments before the state was eligible to receive Federal Aid.

At the time of the passage of the Act many of the State Highway Departments already established were struggling for an existence. A majority of the states did not have a State Highway Department but were compelled to establish one before they were eligible to recieve anything by way of Federal Aid. Thus encouraged the states without departments hastened to establish them.

Much Accomplished by Federal Aid

Under the Act of 1916 much was accomplished and a large mileage of roads have been built. The Congress in 1921 gave to us another Federal Aid Act and provided for the designation of a definite system of interstate and intercounty highways to embrace not more than 7% of the total road mileage of any state. This became necessary because many states were receiving Federal Aid for the construction of roads with no definite plan of ultimately constructing a state system of highways that would connect with the highway system of adjoining states.

The co-ordination of a State Highway system of the various states was most important and a difficult task which has been accomplished both to the satisfaction of the states and the Federal Government.

Approximately 175,000 miles were so designated, and of necessity it will require many years to complete the entire system. We are now working towards the completion of a definite and prepared plan of a National Highway System. Without Federal aid a National Highway System will never be coustructed, is the prediction of many who seem best advised. With the continued co-operation of the Federal Government, which is so vital and necessary to the successful completion of a National Highway System, there can be little doubt of its ultimate and final success.

Nine years have been written into history since many of the states, encouraged and enthused by the first Federal Aid Act, commenced operation on the three fold basis of area, population and mileage, of post roads.

Unprecedented Road Development

While the first appropriation of $5,000,000 was small, it nevertheless set in motion this stupenduous movement of road construction. It may safely be said that the world has never before known such development as has followed since this first Act was passed. However small

the appropriation was it marked the culmination of the best thought of the Good Road Workers of the whole country, and at a time when only the far seeing realized the significance of the economy of improved highways.

The development of the automobile was in its infancy and yet many saw far in advance and understood that the success of one depended upon the other.

The time is now here when practically every family owns a motor car and highway improvement and construction is a public necessity.

Correspondence with the various Highway Departments gives the information that many of the states, and perhaps the average have not completed 50% of their Federal Aid System. Most every one of these states have gone on with their work in spite of opposition from the first in the belief that Federal Aid would continue until its purposes had been completed. Were Federal Aid withheld we would have many states where broken construction programs would result and important links of the System left uncompleted.

The highly valuable service rendered through extensive research work carried on by the Government would be lost. Indeed it may be said that the loss of Government co-operation at this time of the construction program, with all that it means must be and would be a great calamity.

Compared With Subsidies

Those who are advocating the abandonment of Federal Aid at least some of them consider the appropriations highway subsidies. The question naturally arises, what about Army and Navy subsidies, and many others which are expressly provided for in the Constitution itself. The authority for the appropriations of Federal Aid in the construction of highways, is expressly provided for in the Constitution, and as a matter of fact preceded the authorization for both Army and Navy. Section Eight of the Constitution expressly provides and gives power; "To levy and collect taxes, duties, impost and excises to pay the debts and provide for the common defense and general welfare of the United States."

No thoughtful man will deny that when our Constitution was adopted the paramount need of the young nation was the means of transportation to provide communication, and hence to promote the general welfare of the country they provided post offices and post roads.

This is what the Congress meant in 1806 when it authorized the construction of a National road from the headwaters of the Potomac to the Ohio River, and later an extension to the Mississippi River at St. Louis.

When the few states first met at Washington, but few Representatives believed in Federal Aid and we were met with the same argument, that it was unconstitutional. It was not long before the Congress was agreed that when the General Welfare of the United States was written into the Constitution and provisions made to construct post offices and post roads, that the Constitutional right was no longer an issue.

The very states that are now opposing Federal Aid for reasons already stated, in ever increasing numbers are traveling in their course over western roads, and as another has well said: "They would be the first to complain if each state line marked a radical change in road conditions."

Our attention has been called to the fact that the Constitution of the United States gives no specific authority to Congress to make grants to the railroads in extending their lines through the western portion of the United States. However, this policy was considered as being one which promoted the general welfare of the United States. Those land grants gave railroads in excess of 130,000,000 acres, and this gift was further augmented by financial credit in the form of bonds that were issued by said Companies. From the standpoint of the Federal Treasury, the return in proportion to the receipts, for the exclusive benefit of a certain class, we find is entirely disproportionate to the return that is being made to the motor car owners, because the motor cars at the end of 1924 had paid in taxes in excess of $750,000,000 and Federal road appropriations had returned a benefit of less than $325,000,000.

If Federal Aid is continued it will be but a few years when the entire west will have been made available to the eastern tourist, and these same roads will accommodate as never before the interstate business traffic of the country.

One writer has well said, "It is doubtful in the people of the Nation appreciate the magnitude of the problem of highway construction and operation. We are confronted much more frequently with statements as to the expenditures for highways than we are with statements

as to the cost of vehicle operation over highways."

Occasionally we hear complaints about the billion dollars of which about one-tenth is from the Federal Government, three-tenths from the States and six-tenths from local sources, spent for highway construction and maintenance in the United Sttates as excessive. How many can give voice to such complaints realizing that these same people pay each year more than $8,000,000,000 for the purchase, up-keep and operation of motor vehicles, or that the annual sales of new motor cars and trucks amount to more than double the billion dollar expenditure for roads, or that if all of the new cars and trucks sold each year were parked in a single line on the new roads built in the same year the interval between them would be less than 50 ft., and yet these are the facts.

The entire cost of highway construction and up-keep is only about 10% of the whole bill for highway transportation.

At the present time approximately 170,000 miles have been designated for improvement with Federal Aid to become a National highway system.

At the end of November the present year 36,000 miles will have been completed with Federal Aid, and nearly 19,000 miles under construction.

Since the second Federal Aid bill was passed in 1921, construction has progressed smoothly at the rate of from eight to ten thousand miles per year while much additional mileage has been constructed independent of Federal Aid. It has been estimated that about ten years will be required to complete the primary system.

The problem before us is a definite one, to carry on to a completed system a main highway conecting each State of our Country; if it is to be so, Federal Aid must be continued. Without the incentive of this appropriation many States will fall by the wayside. The weakest link is always the strength of the chain, and so it will be that the smaller and sparsely settled States, if not supplemented by Federal Aid will break the transcontinental roads of the Union.

The Government has started a great plan, it has worked admirably and with great satisfaction, and it occurs to me a poor time to abandon the work, or by any Act of Congress to interfere with its completion.

It occurs to the writer that there are few, if any, questions that enter so vitally into the welfare of so many of our citizens as the completion of the great undertaking, to build and complete a National Highway System.

To many the term "Federal Aid" has been a misnomer from the beginning. "Federal co-operation" would be better. The authority for post roads and post offices are of equal importance in Article 1, Sec. 8, of the Constitution of the United States. And being so authorized we feel that Federal co-operation in the building of a National Highway System is a function of Government as important as post offices, as the Army and Navy or any other function which the Government is now carrying out that is mentioned in Article and Section above mentioned.

We believe that Federal Aid is a function of Government and should not be considered as an aid to the state in the sense that it is now thought of. Neither can it be said to be a subsidy, as from the beginning of Government it has been one of its functions and one of the most notable illustrations was the building of the Cumberland Road, commonly known as the old National Pike or Highway, which was extended from Washington almost to St. Louis, built entirely as a Federal function and turned over to the states for operation.

Statesmen of that period, approximately 1820, voiced their sentiment in Congress on this function of Government and demanded internal improvement. Among those improvements was the National Highway. This program was continued until the Federal Government found that it could tie the Nation together more quickly with railroad construction and switched its activities from highway construction to that of railroad construction, and to speed these activities aided railroad development by land subsidies. While we do not question the advisability of the course taken by the Government, we firmly believe that with the advent of the automobile and the desire of the people to know more about their own country and to visit distant places there is a demand upon the Government to exercise to a greater degree that function of Government which each state subscribed to in approving the Constitution. The Congress changed from highway construction to railroad construction for reasons above stated, the more quickly bringing together the states of the Union.

Our new method of highway transporta-

tion equals, or surpasses, that offered by railroads in an earlier period and to keep pace with this wonderful development the Congress who set in motion Federal co-operation until 170,000 miles of Federal 7% System has been started, as it appeals to me, has a moral, as well as legal obligation to keep.

Sources of Internal Revenue

In this article I shall discuss the objections now being made. First of all I take it that a statement of the source of internal revenue received by the Federal Government for the year 1924 may be of interest.

Of the total of $2,767,646,872.60 received last year, Michigan contributed $221,380,005.15; Illinois contributed $214,840,722.14; Pennsylvania contributed $269,888,619.61 and New York contributed $690,415,425.07. In other words aside from New York and Pennsylvania, Michigan contributed to the total of all revenue more than anyone of the other forty-eight States. The excise tax on automobiles, cameras, candy, jewelry, etc, alone amounted to $97,487,065.99, and yet in spite of the objections that are being urged to discontinue Federal Aid, the people of Michigan stand pat on a continuance of Federal Aid for reasons hereinafter stated.

We have been in the habit of publishing to the world what this state does and what that state has accomplished and making comparisons so long that certain results are tabulated as by states, when in reality some of the states would actually starve were it not for their neighbors. Some have plenty of money in their till, but they have no hills or rich valleys on which to raise grain or to raise cattle. Some of the richest states in the Union do not produce one-half of 1% of the basic wealth so necessary to our very National existence. We are all in a sense dependent upon others, both as individuals and as states.

Funds Furnished By a Few States

In entering protest against Federal co-operation with the states in various enterprises, tables have been widely published to prove that a few states furnish more than 75% of the entire amount collected for these purposes, and that they receive in return but a very small portion of what they paid into the treasury, while other states are given sums far in advance of what they pay.

We must admit that the Federal contribution of late years, or the larger part thereof has been for highways. These highway appropriations seem to have been singled out as especially unfair. The fact remains that no state pays more into the Federal treasury than is indicated by its wealth and population. The major part of the receipts of the Federal treasury come from internal revenue and custom duties. These two items last year constituted 83.27% of the entire receipts. It is not unfair therefore to ask who, after, all, pays the bills.

Michigan Pays 43 Per Cent of Auto Excise Tax

In the case of Michigan this question is satisfactorily explained, when we take into consideration that 43% of the total automobile excise taxes of the United States is collected in Michigan, and when we understand that there is an average of $31.00 per car collected, it can be understood how this large sum after all is spread over the entire country for the purchaser of the car pays the bill.

Of the Michigan income tax, the Fords alone pay $21,260,000. As heretofore suggested, be it said to the credit of Michigan that no one makes any claim that they are paying more than their share of the internal revenue, because as a matter of fact the payment of this revenue is distributed all over the Union.

What New York Pays

Many articles have been published in the press to the effect that New York State pays over 25% of every bill that the United States has to meet. The total internal revenue credited to New York, in round numbers is $690,400,000. Of this amount $506,593,000, or over 73% comes from corporation and individual income taxes, and 49.9% of the 73% comes from corporations.

I think it is generally understood in speaking of personal income taxes, that $7,500,000 personal income tax was paid last year by Mr. Rockefeller, and this represented earnings collected from many states aside from New York. In other words, New York takes credit for paying into the Treasury vast sums, which when analyzed demonstrates the fact that these were paid by the various states, in which Mr. Rockefeller was doing business.

There is another thing to be considered: corporations never pay an income tax where there are no profits. In other words, income taxes come only when profits exist. This is not the case in personal obligations above certain exemptions. With corporations, no profits, no income tax.

The corporations whose home offices are in New York pay 25.59% of all the corporation tax of the United States, and still were able to declare cash dividends to their stockholders of over $975,724,000, and also stock dividends of $2,229,570,000. No one finds fault with this.

The total number of corporations in the United States paying income taxes last year were 212, 535, and of this number, 35,504 paid income tax in the State of New York, three times as many as Pennsylvania, and yet as a matter of fact New York has only 11.7% of the total national wealth, while Pennsylvania has 9.2% of the total national wealth.

VARIED USES OF ASPHALT IN CONSTRUCTION AND MAINTENANCE

By Wililam H. Woodward, Superintendent Asphalt Paving, Springfield, Mass.

(Paper presented at Fourth Asphalt Paving Conference, Detroit, Michigan, Oct. 21-23, 1925.)

There are many varied and effective uses of asphalt in highway construction and maintenance. Standard practice may always be safely followed, yet it is evident that there are many other procedures which have been used with good success. While there are certain fundamentals which cannot be disregarded, yet one may observe a great elasticity in methods and choice of materials used to obtain similar objectives.

One city which does constant experimenting and considerable construction of asphalt pavements, is Springfield, Mass. This city builds and maintains all its streets and owns a large bituminous equipment including two asphalt plants. Evidence of the favor with which we view asphalt construction is the fact that over one hundred tank cars of this material were used last year. Our experience has been quite varied and some of the methods and opinions given in this paper are the observations of many years of successes and failures in this City.

Reconditioning Old Water Bound Macadam Streets For Asphalt Surfaces

The policy of reconditioning old water bound macadam streets as a base for asphalt surfaces is followed by many cities. That this practice is sound is demonstrated by the excellent service this type of construction has given under heavy traffic. Furthermore, the economy of utilizing the present material in the street to the best advantage is very evident.

It is very seldom in city work that an old waterbound street is found in such a state as regards crown, grade and general surface condition as will allow the immediate construction of a bituminous wearing course upon it. When the finished grade may be raised and the old surface left untouched except for patching any depressions, the problem is simplified. However, more often a general reconditioning becomes necessary. Two conditions are met with; first, when the depth of the material is sufficient to allow for reconditioning and, second, where the subgrade must be excavated and the old macadam dropped in order to permit the wearing course to be to grade.

When the old water bound has an adequate depth the procedure followed is first to scarify the street in such a manner as to disturb only as much material as is necessary to allow a true surface to be given it. The loose rock is reshaped by a scraper and any new material added where necessary. After this has been rolled, sand or trap rock screenings are used to make the base tight. The road is then sprinkled with water and rolled until firmly compacted. The base is ready for the wearing course.

We have experienced many instances where it is necessary to lower the subgrade and drop the old macadam to provide for a proper thickness for use of it as a base. In this case the surface is scarified to the maximum depth possible. As it is necessary to remove the material entirely and dispose of it temporarily a number of methods are employed. Where possible, the rock is picked up by shovel and deposited on the tree belts. If not, it is removed and teamed to an adjoining street. Sometimes half of the street is constructed at a time and the other half receives the loose material. When the old macadam has been disposed of, the exposed subgrade is lowered to allow for the desired depth of rolled base. The excavated rock is moved to its position on the subgrade and the standard method of constructing a water bound macadam pavement is followed. It might seem that this method is expensive but such is not the case as machinery performs the major part of the operation.

This type of resilient base has given excellent results on our city streets, many of which carry street car tracks. The depth of the base is at least 4 in. and

such a foundation carries a wearing course either of 2½ in. of penetration macadam or 3 in. of sheet asphalt. We this manner which are twelve years old and some sheet asphalt about six years old. Judging from the service these streets render, it certainly has proved good economy to utilize the old macadam streets for such a base.

Preserving Old Water Bound Macadam Streets

A satisfactory solution of the problem of saving a water bound macadam street which is in good general condition is obtained through the use of a bituminous road oil. This treatment requires that street shall be swept clean to remove any foreign material and expose the stone in the surface. Where it is necessary to do any patching in order to bring the surface to a true shape, such repairs are made by rolling a hot mix of ½ in. stone, sand and asphalt into the depressions. The street then receives an application of 1/3 gal. per sq. yd. of 35% Asphaltic Road Oil and the treatment immediately followed by a covering of coarse sand. As there is a tendency for traffic to displace any loose sand which may not have been absorbed by the asphalt, the surface is broomed once a day for at least a week.

We have treated a decreasing number of miles of residential water bound macadam streets in this manner for the last ten years. The deterioration of the old surfaces has been stopped and these pavements now may be easily swept and flushed.

Penetration Macadam

Our method of constructing an asphalt penetration macadam does not vary from the standard practice. However, a few months time after each pavement is built, the new surface is swept clean, treated with an application of 1/4 gal. of 85% Asphaltic Road Oil and covered with sharp coarse sand. A few weeks wear under traffic irons this surface out very smooth. The purpose of this treatment is to establish a finished and tight surface which may be easily swept and flushed. One of our heavily traveled penetration streets, carrying a thousand vehicles an hour, has received this and subsequent treatments every two or three years.

As regards the succeeding resealing of these pavements, too much strees cannot be laid upon the danger of building up a mat which will shove under heavy traffic. A resealing coat of 85% Road Oil is applied only after the previous coat has worn completely away.

Asphalt on Bridges

Mention might be made here of two examples of the use of asphalt on bridges. Recently, there have been two bridges constructed in Springfield, crossing the Connecticut River, which is approximately one quarter mile in width. One of them is of concrete construction and is paved with granite blocks with an asphalt filler. The traffic is quite heavy, counts indicating a normal traffic of 15,000 vehicles a day.

The other structure is of steel construction and carries a concrete base. About 7,000 sq. yds. of standard 3 in. sheet asphalt wearing course was laid on this bridge at a cost of $1.24 a sq. yd. Traffic averages from 8,000 to 9,000 vehicles a day over this surface.

Penetration Base

It has become a practice with us to construct asphalt penetration macadam as a base for sheet asphalt on highways of medium traffic leading from our city. The methods which we employ are somewhat different from the standard inasmuch as one course of rock is used instead of the two course work. This single course construction has proved very satisfactory and is a decided improvement over a water bound base.

Our method is to lay on a properly built subgrade, clean coarse stone which, when rolled, is at a compacted depth of 4 ins. This course is penetrated with 1¾ gal. per sq. yd. of an 85-100 penetration asphalt and imediately covered by an application of 20 lbs. per sq. yd. of ¾ in. stone. This base when well rolled is complete and ready for the sheet asphalt, comprising 1½ ins. of binder and 1½ ins. of top.

The point should be made that all the precautions and care taken when constructing a penetration macadam pavement are observed when building this asphalt base. As the greatest factor relied upon for stability is the interlocking of the stone, full compression is obtained until all shoving has ceased before applying the asphalt. A number of samples which have been cut from these pavements have shown the excellent manner in which the asphalt penetrates the 4 in. rock base.

Black Base

It has been only recently that we have laid any black base in this City. The occasion arose regarding two streets in

the business district where it was necessary to replace the existing pavements, one of granite block on a sand base and the other of penetration macadam, in the shortest time possible. The question of a suitable base for a sheet asphalt wearing course presented itself. The resulting delay during the curing of a concrete foundation was out of the question and then the desirable qualities of a black base became apparent.

Accordingly, the old streets were excavated to allow for a total thickness of 7½ ins. of finished pavement. A mixed base was built in two courses, each 3 ins. in depth, and the wearing course of 1½ ins. of standard graded sheet top laid on the surface. The dispatch with which operations were concluded not only convinced us of the adaptability of this type of construction but was favorably commented upon by the business interests concerned.

Resurfacing Gravel Roads With 85% Asphaltic Road Oil

There are various successful methods of treating gravel roads. Many of them require the use of different kinds and grades of bituminous materials. Each practice deals with local conditions such as the economic considerations, amount of traffic to be carried, equipment available, and the physical characteristics of the materials in the road.

There have been no new gravel roads built in our vicinity for a number of years. The material in them is not of the best and it has been quite a problem to maintain them, therefore, the resurfacing of them became imperative.

The method which we use consists of the application of a light priming coat followed by one of heavier material. It appears necessary to employ a bitumen which has the power to penetrate and not lay upon the surface in the form of a mat. Therefore, we favor the use of an initial coat of 45% road oil followed by treatments of 85% asphaltic road oil.

The procedure of resurfacing which takes place is as follows: The surface of the road is first well scarified and then harrowed in order to break up any lumps and bring a maximum of stone to the top. The loose material is brought to a true shape by a road scraper and firmly compacted by a roller. Water is applied to the surface and the road again rolled. After sufficient time has elapsed to allow for the drying out process, a ¼ gal. of 45% asphaltic road oil is applied. This penetrates the gravel and acts as the sizing coat for the next treatment of 1/3 gal. per sq. yd. of 85% asphaltic road oil. A covering of coarse sand containing much gravel ranging up to ¾ in. in size is imemdiately thrown on and rolled until all the stones are forced into the road. Operations then cease until traffic has worked a maximum amount of sand into the asphalt. This is accomplished in about a week's time, after which any loose material is swept off and ¼ gal. of 85% asphaltic road oil is applied. The same sand and gravel coat as before is spread and then rolled. The road is opened to traffic and great care is taken for at least a week to keep sand on the surface.

The use of sand containing gravel up to ¾ in. size as a covering appears to be very desirable. The stone, when rolled into the newly applied surface, is held in place from below and becomes an integral part of the underlying gravel. Further, this covering is not only held in place on the surface by the asphalt, but also being anchored, helps prevent any shoving of the bituminous material. In this manner we make use of the wearing qualities of an asphalt surface and the strength of a gravel road.

The cost of resurfacing miles of these gravel roads approximates 22c a sq. yd. When one considers that some of this construction carries a traffic of upwards of 2,000 vehicles a day and has not been resurfaced for four years, it is adequate proof of the service rendered.

We favor the use of asphalt instead of tar in all our resurfacing of gravel roads. Apparently the broken up crust of tar and gravel from previous treatments is objectionable and cannot be used to advantage in the new crust as the life of the material seems to be gone. Such, however, is not the case with asphalt. The binding qualities of a properly scarified crust of this kind are retained and the new application of asphalt is measurably smaller in amount.

Patching Material

It is seldom that any of our bituminous macadam pavements require patching except where there are corporation cuts and then a hot mix is used. All public utility cuts in sheet asphalt pavements are repaired with the same material as the original construction. Breaks in surface treated macadam and gravel roads are tended to with a plant mix.

A hot mix patching material which is used to maintain the edges of concrete and asphalt roads and for general purposes where there is any depth of cut, is made of 6% of an 85-100 penetration

asphalt, 64% of ¾ in. rock and 30% of sand. Where it is necessary to patch depressions in brick pavements, general surface repairs, and anywhere a feather edge is required, a hot mix of 5% of an 85-100 penetration asphalt, 80% of ½ in. rock and 15% of sand is used. This mix possesses great stability and will readily flush up. During this last year 8,000 tons of these two, ¾ in. and ½ in., hot mix patching materials have gone through our plants.

We do not use cold patches except in very severe weather, and then only as a temporary repair until a more permanent patch is substituted.

The magnitude of the subject of this paper is such that no attempt is made to cover it in detail. The object sought is but to give in a general way some of the results of our experience with the use of asphalt.

THE PLACE OF SANITARY ENGINEERING IN PUBLIC HEALTH ACTIVITIES

By George W. Fuller, Consulting Engineer, 170 Broadway, New York, N. Y.

(Paper before 1925 meeting, at St. Louis, Mo., of American Public Health Association, Oct. 19, 1925.)

The relation of the engineer to public health work was discussed by Abel Wolman at Detroit last year with the result that much interest has been aroused in the performance of different groups of workers and means of bettering their present functioning. Such betterments should come chiefly through educational, research and administrative lines, respectively.

The expression "Sanitary Engineering" seems no longer to be acceptable to many. At the International Conference in London last year, the President in his opening remarks proposed that the term "Sanitation Engineering" be used. Mr. Wolman at Detroit proposed "Public Health Engineering," and it is interesting to note that a few months ago there was published a book by Earle B. Phelps, Professor of Sanitary Science in the College of Physicians and Surgeons, Columbia University, on "The Principles of Public Health Engineering." A perusal of the excellent introduction to this book is well worth while for all workers in the public health field. It shows clearly that this subject is a broader one than the old orthodox viewpoint with respect to water supply, sewage disposal and garbage disposal. There are many other lines wherein the engineer could and should help in making community life safer and more comfortable. The new scope and the new name make for real progress.

The engineer has to do both with theory and practice. He applies scientific data to the design, construction and operation of various types of structures which cost large sums of money both for installation and for operation. Essentially the engineer who is abreast of the times should know what to build as well as how to build, and he needs ability to secure authorization for funds in competition with other demands.

The engineer should have sympathetic appreciation of other work in the public health field and he ought to have ability to stimulate appreciation by others of his own activities. Co-operation and co-ordination of activities with resulting teamwork are better for all concerned than competition and antagonism with resulting lost motion and delays.

Public health workers should unite into a single professional group with such coordinated subdivisions as will effectively meet changing conditions.

Public health education is undoubtedly moving forward. Its engineering aspects as conceived at John Hopkins, Harvard and elsewhere are being reasonably developed from the new and broadening viewpoint. But education should by no means be limited to that which is available at institutions of learning. Unusual effort should be made to develop a better understanding of public health relations in a comparative sense on the part of a wide range of our citizens, particularly those related in an official capacity to the conduct of public welfare.

To ilustrate, it is believed that from the educational standpoint a real accomplishment has been made recently through the publication by the American Water Works Association of the first edition of its Manual of Water Works Practice. While aimed toward standardization of practice, its usefulness in no small part will relate to the broader and sounder views which it should promote. Progressively there can be developed by such means clearer ideas of what the public health siginifies to a community and what part the engineer and others can perform most advantageously.

Research has been an important factor in showing how engineering works can be suitably designed and built and opera-

ted. Since the World War, such activities on a laboratory scale have been less marked than previously. On the other hand, to the engineer a substantial, necessary portion of his added knowledge comes, not from the small scale investigations closely associated with laboratories, but from careful observations day by day of the operations of large plants in practice. Viewed from this standpoint, the engineers in the public health field have probably been more alert and thoroughgoing than is realized by the non-engineering groups.

These remarks are made without any desire to belittle research as it is ordinarily understood but simply to point out that data from practical operations are important and have not been ignored. Associated with this subject are committee reports at the meetings of the Engineering Section, urging, among other things, better plant operation for water and sewage purification.

Some brief but specific observations on the steady progress being made in the field of public health engineering appear to offer the simplest method of demonstrating the variety of activities that the control of public health actually requires of the engineer.

Public Water Supply

There is a well defined trend for better water supplies. Not only are they becoming safer hygienically, but, in order to be satisfactory they must be of better appearance as to turbidity and color, as well as substantially free from objectionable tastes and odors. That the water supplies are really becoming of better quality is best shown by the progressive lowering of typhoid fever death rates throughout the country, with corresponding saving of human life as was pointed out to our Association at the Boston convention by Dr. Vincent. While research may not be bringing forth outstanding discoveries in the control of water supplies, the engineers are securing year by year helpful data from operating experiences and doing all within their power to place the operation of plants in the hands of competent and reliable operating staffs. Although current progress has not been as spectacular as formerly it is substantial. Much remains to be done in bettering water supplies and it is important for public health workers in other fields to appreciate this situation and to do their part in bringing about needed administrative action and funds.

The report of the Advisory Committee appointed in May, 1922, by the Surgeon General of the United States Public Health Service, to review the Treasury Department Standard for drinking waters and to recommend new standards of water supply quality appeared April 10, 1925. It proposes a more comprehensive and more practically applicable standard than the 1914 Treasury Standard, in that it places the emphasis upon the sanitary survey which that phase of judgment requires.

Noteworthy among cooperative undertakings is the Sixth Edition of the Standard Methods of Water Analyses which has been sponsored, prepared, approved and published jointly by the American Public Health Association and the American Water Works Association.

Helpful cooperation between states has been illustrated by the Interstate Pact between the States of Pennsylvania, Ohio and West Virginia in the matter of phenol-waste control.

In the Melcroft Coal Co. case whereby the Mountain Spring Water Co. sought to restrain the Coal Co. from polluting its Indian Creek water supply, the Pennsylvania State Supreme Court reversed the lower court and gave the Coal Company 6 month in which to remove acid wastes from the streams in question. The U. S. Supreme Court declined to review this finding and it is understood that progress has been made by the Coal Company in removing their wastes to a point below the reservoir, with pending proceedings as to contempt of court because of failure to remove wastes within the six months' time limit expiring last July. This case is making history.

Iodizing Water Supplies

Among newer topics probably the most important is the iodizing of water supplies for the prevention of simple goiter. The chapter on this subject in the Water Works Manual is probably the best exposition and is, in my opinion, of sufficient value to justify all effort through committee activities for five years in the preparation of that Manual. The actual iodizing of water supplies naturally deficient in iodine has not progressed as rapidly as it should, although recently the practice has been adopted at Sault Ste. Marie, Mich., Minneapolis and Virginia, Minn., as well as continued at Rochester, N. Y., where the method was first practiced in this country.

In England, water supplies are iodized at Ilkeston and Heanor, the chief feature being that iodine is supplied continuously

rather than intermittently in accordance with American custom.

Sanitation of Waterways

Research work of importance has been done by the U. S. Public Health Service on the Ohio and Illinois, the latter work in relation to the Chicago Drainage Canal, and in association with the Natural History Survey of Illinois and the Sanitary District of Chicago.

As compared with European practice, particularly in Germany, the method of characterizing streams by the presence of certain typical organisms, as distinguished from the residual oxygen method for studying stream conditions has not progressed in this country so far as might advantageously be the case.

Sewage Purification

The chief item of record here is the fact that large plants for purifying sewage by the activated sludge method have been put in service by the cities of Milwaukee and Indianapolis. A plant of this type to serve 800,000 people is being built by the Sanitary District of Chicago.

The disposal of local sewage in relation to the city water supply of Chicago and to other questions has been reviewed by a Board of Twenty-eight Engineers. Its reports dealing with various aspects of this complicated problem approves a program for building sewage treatment plants so as to relieve promptly the overloaded Drainage Canal. Another important outcome has been the adoption by the City of Chicago of a program for the installation of meters so as to eliminate progressively the needless waste of water which makes unduly expensive the filtering of the city supply as well as the works needed for collecting, pumping and purifying the sewage. There has just been issued an important report by the committee on sewage disposal of the Chicago Board of Review.

At Worcester, Mass., Imhoff tanks and trickling filters have been put in service, replacing the old chemical precipitation and intermittent sand filter plant.

Consideration has been given at several places to the collection of gases of decomposition from tanks in which sewage sludge is being digested. They ordinarily contain some 75 to 85 per cent methane, and may be sufficient to go a long way, especially during warm weather, towards providing power needed in the activated sludge process. In Germany, gases from sludge digestion are sold at several places for delivery into the city gas mains.

In the field of research, mention may be made of the investigations conducted by the State of New Jersey through its State Experiment Station with particular reference to biological activities in Imhoff tanks and sprinkling filters under different operating conditions.

Mention may be made of the Schenectady investigations for the control of odors and the psychoda fly by chlorination, and also of the symposium on "Control of Odors" before the Sanitary Engineering Division of the American Sociey of Civil Engineers last January.

Collection and Disposal of Garbage and Other Solid Refuse

The orthodox view of earlier years as to sanitary engineering nominally included this topic with the two major items of water supply and sewage disposal. It has been well said that garbage disposal was an orphan child of sanitary engineering. Engineers have had only random contact with it and their authority and opportunities for needed research have been inadequate to ascertain what the problem really is in different cities and how works can be best built and operated.

During the war, reduction plants prospered due to high price of grease and fertilizers. The same may be said of hog feeding plants for many small or medium size cities.

Economically, conditions have been much different during the past few years and there has been a well defined trend in the direction of incineration and against reduction and hog feeding, particularly for large cities. Not only are revenues now less favorable to the two latter processes, but the view is growing that garbage disposal should be accomplished in a sanitary way with the cost aspect of secondary significance. The public is less tolerant of offensive odors and seems wiling to pay for needed works selected on the basis of efficiency of service. It is worth noting that sizable incinerator plants have been installed recently at Philadelphia, New York, Toronto, and large plants have been put under contract at Buffalo, Minneapolis and Chicago.

The principal need of this branch of municipal sanitation now in the hands of various competing companies with proprietary devices for sale is a thoroughgoing investigation by competent disinterested engineers to give results commensurate with present public demands for better performance. It is also fertile field for the industrial chemist.

In New York State, the 1925 Legislature passed a law providing for the establishment of districts for the collection of garbage or ashes or both in certain counties, such specially directed to the towns and villages in Nassau County, Long Island.

Elimination of Insects and Vermin

The U. S. Public Health Service has established and maintained on the Mexican border rigid control of Aedes calopus breeding, as protection against yellow fever.

In Florida an enabling act was passed by the Legislature last spring for the establishment of Mosquito Control Districts. These are of importance in preventing yellow fever, malaria, dengue fever and filariasis and in promoting efficiency and more comfortable living conditions.

Activities of Mosquito Extermination Commissions in Nassau County, Long Island, and Hudson, Atlantic, Union and other counties in New Jersey have made substantial progress. More than 30 other county organizations are under-way and the railroads in the south are expanding their useful work in this direction. Greater activity in this work should be supported and encouraged by health workers in other localities.

The comon house fly has long been recognized as a public health problem and there is urgent need for effective campaigns against the menace.

Rat-proof construction has received attention in New Orleans and some other cities although there has been little general consideration given to the elimination of rats along waterfronts, garbage dumps and the like. It needs a campaign of suitable publicity with financial support for an adequate remedial program.

General Considerations

Pollution of bathing beaches particularly along the waterfront in the New York district has received substantial consideration during the last year or two, largely as a result of mild outbreaks of typhoid fever.

Oyster pollution attracted much attention last winter and in some of the joint section meetings this question will be discussed at length and reference made to means of self-purification of oysters under suitable methods of cultivation.

Another question in which engineers are interested is in the nation-wide program instituted by the U. S. Public Health Service for milk control with its associated mechanical and engineering arrangements. There is some indication that milk treatment processes will be ultimately placed under as careful technical supervision and control as similar water supply treatment processes are now placed.

Another field of investigation relates to artificial and daylight illumination in furthering the conservation of vision, especially in schools and industries.

Suitable town planning and housing have been shown to have a marked effect in contributing to a reduction of tuberculosis and other respiratory diseases. Studies of the quality of air in certain industrial plants and in congested centers have been helpful in showing and mitigating the effects of harmful dust and gases, particularly with relation to carbon monoxide from automobiles in busy traffic ways.

PAVING PLANT INSPECTION

By W. J. Emmons, Highway Research Specialist, U. S. Bureau of Public Roads, Washington, D. C.

(Paper presented at the Fourth Asphalt Paving Conference, Detroit, Mich., Oct. 21-23, 1925.)

Three lines of endeavor are open to those who seek improvement in the quality of asphaltic pavements. First, that leading to more intelligent design through research in the properties of materials and their combinations; second, that having as its object more careful regulation of the preparation of the paving mixtures; third, that pointing the way to better construction methods. The present paper deals with the second line, which, although it perhaps does not offer the alluring opportunity for research and discovery presented by the others, does undoubtedly play an important part in obtaining proper construction.

The proposition that successful construction depends equally upon adequate specifications and faithful execution surely requires no demonstration. Nevertheless, in the case of asphaltic pavements it is not uncommon to meet public officials and even engineers who feel that the contractor, under nominal supervision, may be safely entrusted with the perparation of the mixture and that the expenditure of a part of the generally limted paving fund for inspection is not justifiable.

There are several good reasons why competent inspection is essential and should be provided for in the specifica-

tions. The contractor is ordinarily a contractor only and not a paving technologist. He is primarily interested in the operation of his plant and in sustained maximum production. He desires quality certainly, but he also is eager to make a profit and his interests are inherently opposed to many of the refinements which are essential to best results. Perhaps the continued existence in some localities of the maintenance clause is in recognition of these facts. If so, it is certainly a less scientific, uneconomic and uncertain method of attempting to insure satisfactory construction.

From the contractor's standpoint the presence of an inspector should be and generally is regarded as welcome assistance rather than as an additional worry added to his burdens. A competent inspector is often able to work out satisfactory combinations of aggregates which individually fail to meet specification requirements thus saving the contractor considerable financial loss. Most important of all, however, is his relief from responsibility for the quality of the mixture which under the inspection plan should be definitely assumed by the engineer.

In delegating authority to the plant inspector the rights of the contractor to operate his plant and organization in his own way should be clearly recognized. There should be no interference on the part of the engineer's representative in any matter not influencing the quality of the product. He should possess authority to pass upon the suitability of materials, to direct the processes of proportioning and mixing, and to obtain, through the contractor, assignment of laborers competent to perform these latter duties under his immediate supervision. A word of warning is in order, however, lest the contractor, noting the interest of the inspector, attempt to delegate to him for limited periods full charge of the plant. This is going too far in the matter of rendering assistance as it relieves the contractor of responsibilities which only he may properly carry.

Many duties await the inspector upon his arrival at the plant. The plant itself should be examined, with special reference to the proportioning apparatus. Specifications preferably and generally require that all materials shall be weighed but scales sometimes get out of order and result in troublesome variations in proportioning which are very difficult to locate. Consequently both the asphalt and aggregate scales must be checked by means of test weights or sacks of aggregate previously weighed upon any available scale of known accuracy. The bins and screens also should be examined for breaks, mixer paddles for length, and, in general, the inspector should familiarize himself with the condition and operation of the plant.

As there is no time for detailed tests at the paving plant it is necessary that sources of supply be approved before any materials are ordered by the contractor. Then as shipments arrive they should be examined for conformity with the governing specifications. In general, no test other than the penetration test for consistency can be made upon the asphaltic cement at the paving plant. With the consistency ordered to fall within 10-point limits, as is becoming the practice, this test is merely a check upon the grade supplied by the refinery. Should asphalt requiring fluxing be used, the test assumes greater importance and becomes a means of determining the proportions of refined asphalt and flux to be used and constitutes an essential check upon the thoroughness of combination. Observation of results over a period of years as well as the results of certain service tests lead to the conviction that the consistency of the asphaltic cement may prove to be a considerably less important factor in the behavior of asphaltic pavements than has been believed. Test pavements of asphaltic concrete laid and subjected to traffic by the Bureau of Public Roads at the Arlington, Virginia, outdoor laboratory, included satisfactory sections containing asphaltic cements of 45, 55, 65 and 75 penetration, although it is true that those with the hardest asphalt were as a whole more stable. In a series of sheet asphalts laid upon the same location, there proved to be little, if any, difference between the behavior of a section mixed with 31 penetration and another with 55 penetration asphaltic cement.

Sieve analyses for graduation should be made upon the dust, sand and coarse aggregates, and, if possible, this work shauld be done before shipments are unloaded. It is vitally essential if uniformity of the mixture is to be obtained that aggregates of dissimilar grading characteristics be stocked in clearly defined separate piles. Based upon materials at hand and preferably predicated upon previous laboratory tests a formula for the mixture must at this point be worked out. When this is done the plant may begin operation.

During the period of plant operation the inspector should station himself in such a position that he can watch every detail of proportioning. With most plant arrangements this point of vantage is the mixing platform from which may be observed the weighing of the asphaltic cement and the aggregates, the measurement of dust, the temperature of materials, and the feeding of the cold materials. Periodic sieve tests of the hot aggregates are sometimes required of inspectors and although these are desirable as records, careful preliminary tests from the stock piles should give all necessary working information and eliminate the danger of irregularities which may occur unobserved while the inspector is away from the immediate scene of operations.

Asphaltic mixtures are unstable when they carry an excessive amount of bitumen and it is felt that the regulation of the bitumen content is the most important single detail under the control of the inspector. With constant feeding of uniform aggregates variations in weights of asphaltic cement may occur through carelessness on the part of the laborer entrusted with this detail. Variations may also occur at the beginning of the day's work or when, after delays, the asphaltic cement bucket is cold. At such times the bucket may retain sufficient of the weighed amount to cause a decided deficiency in the mixture. Should the weights be adjusted and more asphalt weighed to counteract this tendency, later batches will be rich unless further readjustment is made as the bucket becomes heated.

Improper feeding of cold aggregates, when two or more materials are being combined, will result in a non-uniform mixture. This may prove harmful by unbalancing the aggregate combination but it is believed that the effect upon the bitumen content is even more serious. With the same weight of asphaltic cement greater fineness will result in clean mixtures and a decrease in fine sizes will render the mixture rich. If an asphaltic concrete is being prepared in a single bin plant, particular care must be taken to feed uniformly and accurately all of the materials or variations such as occur with poorly proportioned sands will result to an extreme degree. As an illustration, assume that a mineral aggregate mix consisting of equal parts of stone and sand is being run. The stone will carry possibly 2 per cent bitumen, the sand may carry 10 per cent and the mixture then should carry 6.2 per cent bitumen. If a batch is weighed correctly in total amount but irregular feeding has resulted in an aggregate containing 60 per cent stone and 40 per cent sand, the mix should carry 5.3 per cent bitumen. If the batch is actually mixed with the formula percentage of bitumen it would then be rich by 0.9 per cent. It is the presence or absence of such inconsistencies which make the difference between success and failure.

Sheet asphalt test pavements recently constructed and tested under traffic by the Bureau of Public roads illustrate most effectively the danger of excessive bitumen. Plugs placed in the pavement on white lines across the lines of traffic provided a means of measuring the longitudinal displacement of the mixtures.

The behavior of two series of sections, was observed one with a fine and the other with a coarse sand, each with a variation of the bitumen content within wide limits. Suppose an aggregate composed of equal parts of fine and coarse sand is being used. It is probable that such a sand would carry about 10 per cent of bitumen and failure of the organization to feed fine sand for a few minutes would result in a aggregate which, when combined with 10 per cent bitumen, would be almost sure to displace badly under traffic.

To prevent such occurrences requires alertness on the part of the inspector. Batches of aggregate showing lack of uniformity should be discarded without hesitation as should also those to which an excess of bitumen has been added. The old practice of throwing in an additional quantity of dust to compensate for excess bitumen is dangerous and should not be permitted.

Until a laboratory test properly correlated with service behavior of mixtures is devised no method better than application of the familiar pat test can be suggested to determine when the proper amount of asphaltic cement is present in sheet asphalt mixtures. This simple test has its weaknesses but can be made quickly and in the hands of an experienced man may be depended upon to maintain a uniform mixture. It is believed that the stain should be very light, particularly if heavy traffic is to be borne by the pavement. The pat test is, of course, not applicable to asphaltic concretes and maintenance of a fixed percentage of asphalt in types containing

coarse aggregate is only possible through trained visual inspection.

Recently there has been a tendency to permit considerably higher temperatures of mixing than was formerly the case. It is probably true that in this manner a more uniform distribution can be obtained particularly with the leaner and higher filler mixtures which are now being advocated. It is likely that the asphaltic cement is hardened to a certain degree and this, of course, may be harmful if extreme temperatures or if asphaltic cements of great susceptibility are employed. The extent of hardening with a given asphaltic cement cannot be accurately determined at the present time as a satisfactory method of recovering asphalt from pavement mixtures has not been devised. Observation has indicated that 375 degrees F. is very likely a safe temperature for sheet asphalt. Quite a different condition holds with asphaltic concrete, as it is desirable for the stone to carry a coating of the sand mortar when it leaves the plant. This condition somewhat counteracts the tendency toward segregation of the coarse particles in raking on the street and thus results in greater uniformity of construction. At temperatures around 325 degrees F. the sand mortar tends to leave the surface of the stone and consequently it would appear preferable to use this figure as a maximum working limit.

In this paper no attempt has been made to outline a working program or to enumerate all of the details included in the procedure of plant inspection. It has, however, been attempted to indicate the extreme desirability for such supervision and to emphasize certain high lights which are of paramount importance in securing durable construction.

ACCOMPLISHMENTS UNDER THE CHICAGO CITY PLAN

By Eugene S. Taylor, Manager Chicago Plan Commission, Chicago, Ill.

The authors of the Plan of Chicago were Daniel H. Burnham, Edward H. Bennett and a staff of notable artists and technical men. Mr. Burnham was persuaded to undertake the task by the Commercial Club of Chicago, an organization of 100 of the leading business and professional men of the city. These men had seen Chicago's swift industrial and commercial development; they believed that the future had even greater things in store on condition that the future city were intelligently anticipated and provided for. Many of the members of the Commercial Club had been directors of the World's Fair and wanted to preserve the beauty and order which they had seen so well exemplified in the fair. The Commercial Club contributed the money required for laying out the plan, and it also contributed valuable ideas and suggestions born of ripe experience in the conduct of large-scale business.

Purpose

The purpose of the Plan of Chicago is two-fold. Regarded in one light, it is a commercial proposition, as shown by the fact that the projects in the plan are so designed that the city's streets, arterial highways, railroads and waterways may be put to their highest and best uses, for the utmost economy in the conduct of business.

Regarded in another light, the purpose of the plan is a social or humanitarian one, because the plan aims to conserve the natural resources—the woods and water—surrounding the city for the health and pleasure of the citizens; to establish large and small parks, playgrounds, and bathing beaches; to reclaim neglected neighborhoods; to give the worker quick and easy access to and from his home and his work; to reduce the cost of doing business and therefore the cost of living; and, in a word, to make Chicago a highly desirable place for residence as well as an equally desirable environment for business.

Recommendations Contained in the Plan of Chicago

The Plan of Chicago therefore recommended, in line with this two-fold purpose, the development of the lake and river fronts; and the acquisition of the woodlands all about the outskirts of the city for a permanent forest preserve. It recommended the development of a circuit of streets for through traffic about the "loop"—as the central business district of Chicago is called. It recommended every possible connection practical to connect the loop with the other sections of the city, and the sections with each other, in order to produce a unified city. It recommended the co-ordination of city streets with the highways exterior to Chicago. It recommended proper rail and water terminals. In addition, the plan makes certain other recommendations looking toward the harmonious and economical physical development of the city.

Organization of Chicago Plan Commission

The technical work on the Plan of Chicago took two years. Then the conclusions and recomendations, the maps, plats, diagrams, and designs were published in book form by the Commercial Club, and the plan was ready for use. It was thereupon presented to the city as a gift from the Commercial Club, with the recommendation that a commission be appointed to study the plan and advise about its execution. This was accordingly done. The mayor appointed 328 representative men with Charles H. Wacker as chairman and Frank I. Bennett as vice-chairman, to form the Chicago Plan Commission. The commission has no executive powers. The execution, therefore, of Chicago plan projects rests with the public officials, certain of whom are always ex-officio members of the Plan Commission. The commission enjoys today and has always enjoyed the hearty co-operation of the men in public office.

Accomplishments of Plan Commission on Plan

The Chicago Plan Commision was established in 1909. Its efforts ever since have been directed toward carrying out first those improvements which would yield the greatest benefit to the greatest number of people, and which—if they were to be made at all—would have to be made without delay. Such a course of action clearly pointed to the conservation of the city's natural resources; to the speedy improvement of street traffic conditions within the loop; and to the unification of the city by means of new connections between the loop and the three sides of the city, as well as improved connections between the sections of the city distinct from the loop. Parts of this program have gone on simultaneously from the outset of the commissioner's operations.

The conservation part of the program is going forward rapidly. The lake front is being reclaimed for park purposes for five miles to the south of the center of town. The work is being done by the Board of South Park Commissioners in accordance with the Plan of Chicago. The new park lands will be 1,138 acres in extent with a lagoon 600 ft. wide in the center of the whole length. This park is being laid out with drives, and it will be equipped with every facility for outdoor recreation for all seasons, including numerous bathing beaches. The Board of Lincoln Park Commissioners is engaged in extending Lincoln Park north to the city limits, in harmony with the Plan of Chicago. Eventually the new drives to the south will connect with the drives in the Lincoln Park system, so that Chicago is about to have a waterfront drive for the extent of the city and well beyond in both directions—approximately forty miles in all. These lake-front park projects have proved to be popular, and the voters have readily authorized large sums of money from time to time to carry them out.

Another popular movement has been that to acquire the forest preserves. The total acreage thus far acquired by the Forest Preserve District of Cook County is 28,154.50 acres (out of a possible grand total of some 35,000), purchased at a cost of $13,669,948. They are meant to be country playgrounds for a great urban population, and they are being kept in a state of nature, except where simple conveniences have been supplied for visitors.

With respect to the improvement of the Chicago River: The Chicago Plan Commision in November, 1917, recommended a plan to the City Council whereby the south bank of the river from Michigan Avenue to Market Street might be reclaimed, and at the same time the street facilities of the loop enhanced by two immensely important new streets, one above the other. The whole project is known as the "South Water Street Improvement," and construction work has been going on for nine months under the jurisdiction of the Board of Local Improvements of Chicago. The new embankment will have two levels, the upper 110 ft. wide for all classes of traffic, and the lower 135 ft. wide, 25 ft. of which is dock space. This lower surface will be used entirely by heavy commercial vehicles, three lines in each direction at the same time. It will provide a direct route along the northern edge of the loop district, unobstructed by any cross traffic, for the commercial vehicles traveling between the boat and rail terminals east of Michigan Avenue and the warehouses and terminals on the west side of the city. The lower level of the new embankment gives the city the equivalent of an entirely new street. The upper level displaces the South Water Street produce market, which has for fifty years or more absorbed South Water Street, practically closing it to general traffic. The restoration of the street as a public thoroughfare is going to be of great significance, all the more so, as this street is designed

to form the northern edge of a circuit of wide and improved streets around the loop. The purpose of this circuit, or quadrangle, rather, is to enable through-bound traffic to skirt the loop rather than to have it go through it and add to the congestion there. The quadrangle is the basis of the street circulatory system in the Plan of Chicago. The streets comprising it are South Water Street on the north, Roosevelt Road on the south, Michigan Avenue on the east, and Canal Street on the west.

Roosevelt Road, the southern edge, has been widened from 66 to 108 ft. from Wabash Avenue to Michigan Avenue and from Canal Stret to Ashland Avenue—a distance of over two miles. For the stretch between Wabash Avenue and Canal Street, Roosevelt Road is carried over the Chicago River and the adjacent railroad tracks by means of a bridge and viaduct together about a mile and a half long and 118 ft. wide. These are under construction and are scheduled to be completed in 1926. The cost of the whole improvement will be approximately $10,000,000.

Michigan Avenue, the eastern edge of the quadrangle, has been widened from 66 ft. to 130 ft. between Randolph Street and the river, and to 141 ft. north from the river to Chicago Avenue, a total distance of about one mile. This improvement is on the two-level plan for the purpose of separating east-and-west and north-and-south traffic in one of the most congested parts of the city. The upper level extends from building line to building line from Lake Street to Ohio Street, one-half mile. Michigan Avenue is carried over the Chicago river via a two-level bascule bridge 235 ft. long and 90 ft. wide. It is flanked by plazas approximately 225 ft. square on the upper and lower levels at both the north and south approaches. The street was opened May 15, 1920. The cost of the improvement was approximately $16,000,000.

The Michigan Avenue, South Water Stret, and Roosevelt Road improvements have been or are being executed by the Board of Local Improvements and the Department of Public Works of the City of Chicago. When we come to the fourth edge of the quadrangle—Canal Street, at the west—we find Canal Street being widened to 100 ft. from Roosevelt Road to Washington Street under the supervision of the Commissioner of Public Works in accordance with a city ordinance, but financed entirely by the railroads which own all the abutting property. The improvement of Canal Street is very near completion. The operation of the quadrangle will relieve the loop of through-bound traffic—25 per cent of the whole; while the removal of the produce market caused by the South Water Street improvement will take the market vehicles, which now represent 16 per cent of the vehicular traffic in the loop, off downtown streets—a total reduction in loop traffic of 41 per cent.

An insufficient number of through streets is the greatest handicap under which Chicago traffic labors outside the loop. The Plan of Chicago fully recognized this and the Plan Commission has made many recommendations for the opening, widening, or extending of strategically located streets, among which are the following:

Ogden Avenue, a radial street, has been extended to Lincoln Park from the west side of the city, a distance of three miles. The 108-ft. wide extension has been completed by the Board of Local Improvements, but the section across Goose Island and the north branch of the Chicago River remains to be bridged. This will eventually be done, but until then traffic will have to detour around Goose Island and cross the river on a temporary bridge. This improvement is notable in that it connects the north and west sides of the city, and in that it gives to the city an entirely new diagonal street.

Western and Ashland avenues and Robey street are three major north-and-south streets which the Plan Commission has recommended be made through streets practically from city limits to city limits. Construction work on the first two is going forward under the Board of Local Improvements. Western Avenue varies in width at 18 different places from 50 to 330 ft. It is to be made a minimum width of 100 ft. throughout its length. Ashland Avenue is now open at four places and varies in width from 42 to 100 ft. in 28 different localities. It is to be opened where it is now closed and made not less than 100 ft. wide all the way through the city. The improvement of Robey Street has not reached the construction stage yet. This street is closed in nine places and varies in width from 30 to 100 ft. in 19 places. It is to be opened where it is now closed by means of viaducts 66 ft. wide, so designed that they can easily be widened to 86 ft., the

width which the Plan Commission recommends for Robey Street. The effect of these wide continuous thoroughfares will be to facilitate traffic very greatly and further to unify the city.

On July 15 an important addition to the city's boulevard system was formally opened. It consisted of extending Grand Boulevard for slightly over a mile by widening South Park Avenue from 66 to 198 feet. At 23rd Street the new boulevard is carried over the right of way of the Illinois Central Railroad Company by means of a viaduct, to connect with the drives in the new lake front park. The work was executed by the Board of South Park Commissioners. It is impossible in a paper of this length to point out all the far-reaching effects of an improvement such as this, but perhaps the most striking is that business now has an opportunity to expand to the south as it did to the north after the completion of the Michigan Avenue widening.

Many other valuable street widenings are either under construction or have been provided for by ordinance of the City Council.

The negotiations for the new lake front park included the rehabilitation by the Illinois Central Railroad of its terminal facilities; and the railroad is now at work electrifying its suburban trains, after which electrification of the through passenger and the freight service within the city limits will follow. A new terminal is planned for Roosevelt Road fronting upon Grant Park. The whole Illinois Central project is to cost approximately $88,000,000.

A second great terminal project has been brought to completion with the formal opening of the new Union Station on July 23 of this year. This terminal serves five railroads, and includes, besides passenger station, a large number of improvements made by the railroads in return for concessions from the city. These were in the nature of street, bridge, and viaduct improvements and were in accordance with the Chicago Plan Commission recommendations. They were estimated to be worth seven and a half million dollars to the city because that is approximately what it cost the railroads to make them. The whole Union Station development cost, in round figures, $75,000,000.

There are still other groups of railroads which have prepared plans for loop terminals to replace and improve upon the facilities now in use. Intimately associated with the proper solution of the problems of these railroads is the straightening of the south branch of the Chicago river from Polk to 18th Streets, which the Chicago Plan Commission vigorously advocates, and for which the Federal Government gave its consent in 1923.

From the standpoint of the relief of traffic congestion the river straightening would be one of the most effective things that could possibly happen, for it would then be possible to extend five loop streets south to conect with their southerly extensions through the city, and with Archer Avenue—a great diagonal artery extending southwest through and beyond Chicago. As it is now, these five streets —Market, Franklin, Wells, LaSalle, and Dearborn—come to a stub end just south of the loop because of a decided bend in the river, and the traffic which they should bear is thrust on to the few and overcrowded through streets which Chicago now has. The present city administration has been very actively pushing this project, while a committee of citizens appointed by the mayor is negotiating with the railroads.

It is hard to do justice to the Plan of Chicago and the progress that has been made upon it without the aid of maps and diagrams upon which to point out the true significance of these improvements. Each one is able to stand alone on its own merits as abundantly worth all it cost, and yet all interlace to form the most logical physical layout that is possible for Chicago. It is a complicated matter to remodel the face of a city like Chicago, and the Chicagoans are thankful that they have a plan to guide them. They are already enjoying the benefits of such parts of the plan as have been carried out, and they expect to gain more and more advantage from it as time goes on.

The foregoing paper was presented at the 1925 meeting of the American Society for Municipal Improvements.

A DISCUSSION OF MUNICIPAL FINANCES

By Chester E. Rightor, Chief Accountant, the Detroit Bureau of Governmental Research, Detroit, Mich.

As engineers engaged in various phases of governmental activity, we must concern ourselves more and more with public finances. Indeed our interest is two-fold, first, in our official capacity, and second,

as citizens and taxpayers. Failure to express our plans and work in terms of dollars and cents, whether through aversion to figures or merely through neglect, is a handicap to the engineer in public life. Instances are numerous of geniuses as producers and organizers who are wholly lacking in a practical business sense, based largely upon finances. To know how to read and interpret a balance sheet an income statement, and a profit and loss account is no disgrace, and today in public life is being found more and more essential.

War and post-war conditions have brought to the forefront governmental finances to an unusual degree. This interest has arisen primarily because of the tremendous increase in public expenditures and debt, and secondly because of the large number of people who, for the first time, through subscriptions to Liberty Loans, have become investors and holders of governmental securities.

Prior to the World War, the Federal debt was slightly less than one billion dollars; today it is approximately 21 billions. Similarly, before 1924, our Federal expenses were slightly less than one billion dollars; expenditures now total over three billion dollars annually.

Further, our states and cities have a total net indebtedness estimated at $10,500,000,000, or over $100 per capita, and are issuing bonds at the rate of about $1,500,000,000 annually. Expenditures of states and local governments (including cities, counties, school districts, etc.), are $4,300,000,000 each year.

How are these large payments met? The national income is estimated at $65,000,000,000 per year. Accepting this figure, the Federal and local governments require somewhat over 10 per cent of the national income of every man, woman and child for their purposes. It might be added that the wealth of the nation is estimated at $320,000,000,000, of which approximately one-half is assessed for purposes of taxation.

The foregoing statistics serve to indicate the relative importance of governmental activities as reflected in total figures for the nation. When comparisons with ten years, or even five years ago, are made, the growth of public services is clearly shown.

Demands for Improvements

It is equally manifest that the tendency of governmental activities is toward further expansion. Year by year the budgets of our states, cities and other local units increases, not only in total amounts but also in per capita expenditures. As the reports of the Census Bureau show, the expenditures are increasing at a substantially faster pace than the population. This is a natural situation as respects governmental costs. These increases are the result, ordinarily, of popular demands, and so far as they truly represent the duty and opportunity of the city to function more adequately for the welfare of the community, the services must be undertaken.

In a recent survey by the Detroit Bureau of Governmental Research, it was disclosed that the city of Detroit was rendering nearly 200 specific public services to its citizens. In 1900 the city had 102 activities at a cost of $3,500,000 in taxes; by 1910 the number had increased to 114. Thus, during the last 15 years the number had nearly doubled, with an increase in the tax budget from $7,000,000 to $56,000,000.

Similarly, Wayne County, with Detroit as the county seat, reports 60 different distinct services. Analysis in any city, while not attempted here, would disclose a condition paralleling Detroit's.

Federal vs. Local Governmental Costs

President Coolidge has pointed out recently the reduced Federal expenditures and costs of government, and wins almost universal approval with his suggestion that states and city governments should follow the Federal example of economy and retrenchment. With all due deference to the President and Budget Director Lord, your Committee believes that this Society should have a full and non-partisan understanding of the facts. Thinking groups of citizens everywhere must bear in mind the fundamental differences between the Federal and our local governments.

The services to the individual by the Federal Government are indirect and remote; those of the state and local government are more direct and intimate. It is believed by your Committee to be wholly unreasonable to expect a reduction in cost of local government corresponding to that of the national government.

It is true that, compared with war days, the present cost of the Federal Government is substantially lower; compared with pre-war days, however, the nation has a long way to go. Debt and interest

payments by the Federal Government are reducing the total budget. For local units, the levies for debt service are increasing, by the very nature of their material expansion and development. These facts were brought out forcefully by Governor Smith, of New York, at the Governors' Conference at Poland Spring, Maine, in June. In this connection it may be predicted that when Comptroller-General McCarl, who occupies a position of unsurpassed financial power, fortified by a 15-year term in his freedom from presidential and congressional pressure, really begins to function in his task of investigating the "application of public funds," drastic moves toward economy will result.

The benefits of the Federal Budget and Accounting Act of 1921 are recognized. The President has a greater control over appropriation bills; estimates of appropriations are subject to as many as eight separate reviews before submission to Congress; appropriations may be correlated with the finances of the nation; and through the General Accounting office an independent audit of executive accounts is provided.

Dr. Edward B. Rosa, when with the Bureau of Standards in 1921, made an exhaustive analysis of the government's finances, according to basic functions of protection, commercial, and development. He reported that, for 1917-1920, 93 per cent of the Federal expenses were for protection, war and the effects of war. Today, military functions cost approximately 80 per cent of the total Federal expenditures. This is a condition which does not permit of comparison with local governments. Demands upon the Federal Government are diminishing, except sporadically, while upon our local governments they are multiplying.

Growth of City Government

It is well to inquire into the causes for the expansion of city and local government.

Invention and discovery have made for an intense congestion of population, which added to local governmental services as traffic control, street widenings, heavy pavements, fire protection, street lighting, water supply, etc.

Higher standards of living compel cities to provide added educational facilities, maintain parks, etc.

Increased humanitarianism prompts better prisons, care of the sick, playgrounds, etc.

Scientific development compels the technical and expensive administration of public health, disposal of wastes, water supply, etc.

Thus we find local government has had to spend more for schools, highways, protection of life and property, institutions, sanitation, etc.

The present day tendency is for a further demand for more and better governmental service, operation and regulation. In your respective fields of endeavor and your own city, each of you could cite numerous instances of such demands.

Probably these are foremost in the educational field, but those services with which most of the membership of this Society are concerned are also affected by varying degrees.

Limits Upon Public Funds

The engineer engaged in public service is required to give consideration not only to these popular appeals for engineering services, public improvements and modernized machinery, but to the other side of the picture as well, the available funds for these improvements.

It will be found that there are very definite limitations upon public funds available for these purposes, limits unlike those affecting private business. These include the budget, statutes and local laws limiting taxes, limitations upon bonds issues, and certain practical limitations. The enginer in public life should deal with these economic barriers in the most intelligent manner.

In order to lay the basis for concrete discussion, the effect of these several limitations upon any city will be indicated by a statement of the experience of Detroit. It is believed that these conditions and experiences are applicable, with due modifications, to almost any city.

Experience of Detroit.

Detroit has a population, according to the 1920 census, of 993,000 (now estimated at 1,200,000), an area of 120 square miles, a net bonded debt of $161,000,000, assessed valuation of $2,757,000,000, a total budget of $125,000,000, of which $56,000,000 is taxes at a rate of $20.38 per $1,000.

Ten years ago, the comparable figures were but a fraction of the present amounts. Subsequent to the war, by reason of doubling its area and population through annexation and natural expansion, the city was confronted with an unusual problem of providing extensions to

its existing public improvements—highways, transportation facilities, water, sewers, schools, playgrounds, etc., as well as the requisite extension of the ordinary operation and maintenance. The need for improvements was accentuated by the enforced retrenchment invoked by the Capital Issues Committee.

As a result, Detroit found it necessary to expend $150,000,000 for permanent improvements during 1919 and the succeeding four years, bond issues of $140,000,000 providing most of the funds.

In this connection, it is pertinent to recur to the frequently published assertion that our cities of today are extravagant in their expenditures. Such charge is commonly made upon the front pages of some types of newspapers, but is clothed in glittering generalities rather than in citation of specific instances of waste or over-indulgence. It is popular to lay the blame to the ease of borrowing by cities due to the tax exempt feature of the bond laws, and also to the freedom of spending occasioned through the war.

The expenditures by Detroit, however, will bear the light of publicity. An evidence of this is that over $70,000,000 of the expenditures were authorized by vote of the people; and further, of the total expended $30,000,000 was for schools, which have never been submitted to a referendum. To argue that the people can not decide such questions intelligently is to indict our form of government.

Today Detroit has outstanding authorization for public improvement bonds issued, amounting to $70,000,000, many millions of which have been voted by the people. By charter and Michigan statutes, the city might have a bonded debt of $245,000,000, not including many millions for subways and an unlimited amount for schools. By a statute enacted at the last session of the legislature, all bond issues must be approved by the State Treasurer, and can be so approved only when the sufficiency of the sinking fund is shown. Detroit's sinking fund is adequate. Under the terms of a New York bond law, however, it may sell bonds in that market for only $36,000,000 of this amount.

What Can Be Done?

This is the situation confronting Detroit and probably would be duplicated in most other cities. What are the steps to a solution in Detroit and elsewhere?

First, cities must give attention to the annual budget which is a financial statement of what the city proposes to do, the cost of these activities and services, and how to finance them.

The budget should cover all the city's activities, and the activity should be the unit of estimate and appropriation. The data presented in support of the program should be in an attractive and interesting form easily comprehended by the citizen. Detroit has a modern and effective budget procedure and last year created a Budget Bureau to further improve the document. There is need in every city to urge further public attendance and participation in the public hearings upon the budget, in order that our democratic form of government shall continue.

This one subject of budget making could be greatly expanded for consideration and discussion by the Society, but it is desired here merely to suggest that the activity of the organization should be the unit of appropriation, as street cleaning, street repair, etc., rather than the broad function of department of streets. Second, the budget might well set up a complete picture of what the needs of the community suggest should be accomplished ultimately by the various units, for example, a 100 per cent statement annually of the streets needing repaving, widening, etc. Third, the budget might be expressed in terms of work to be done as well as objects to be purchased—miles of streets to be cleaned, square yards to be repaved or repaired, etc., rather than the conventional estimates for labor and asphalt and truck, etc. Fourth, in support of the proposed work program should be submitted a statement of the actual cost of work done and estimated cost of work to be done. Thus cost records would come into their own in public business as in private business. And these proposals are as applicable to municipal departments generally as they are to the department of public works. It is not assumed that they are new and novel, but they are pressing for realization in public affairs.

Hand in hand with revised budgetry methods might be suggested the need for annual reports prepared in brief, readable, fact-stating form, telling the citizen in direct and understandable manner what has been accomplished for the government during the year.

Second, in addition to the annual operating budget, cities must give attention to a long-time budget of public improvements. Detroit, through a commit-

tee of business men appointed by Mayor Smith, last spring prepared such a budget, amounting to nearly one-half billion dollars.

Estimates were received from the various departments, boards and commissions of the city aggregating $780,000,000, not including super-highways, port development, and possible annexations. Analysis of available sources of revenue to pay for same, taxes, bond issues, special assessments, and departmental revenues, made it obvious that though the improvements might all have merit, they could be financed only with an exceptionally high tax rate. The Committee recommended a budget of $445,000,000 for the ten years, and showed how this amount could be financed under existing practical legal and financial limitations and yet result in an average annual tax rate of $20.65 per $1,000, which would not be unduly burdensome upon home owners and industries.

Our cities might well set to work outlining the program for the acquisition or construction of public works and buildings, and we find that St. Louis, San Francisco and Kansas City are among those cities which have given thought to this procedure. Improvements needed by most cities can be acquired only gradually due to the pressure of finances and it becomes necessary to weigh one class of outlays against the others. Public works must compete for funds with schools, parks, playgrounds, hospitals, prisons, fire departments, etc.

Third, legal tax limits must be recognized until removed. As stated, Detroit has a charter tax limit of 2 per cent of the assessed valuation of $2,757,000,000. The city of Detroit is definitely limited to a tax budget this year of $55,000,000, exclusive of schools. Other cities commonly have definite tax limits. Such limits must govern the chief executive in co-ordinating the several public services, and should be borne in mind by the operating departments in preparing their estimates. The vagaries and frenzies of Ohio's now famous 1 per cent Smith Law in its repressing effects upon the cities of that state are probably well known to you.

Whether there should be any tax limitation upon a city, and what such limitation should be, are questions of individual and community decision. The average tax burden upon cities of over 30,000 population for all purposes is reported by the National Municipal Review to be about $25 per $1,000 or 2.5 per cent. Is this excessive, or can it go to 4 per cent? Indications are that the burden will increase —and further, it may be predicted that schools will receive a growing portion of the tax dollar.

It seems manifest that if a city has an effective budget procedure, no tax limit should be needed. By means of the budget the people, through their legislative body, decide upon a program of current activities to cost a certain amount. This total cost should be financed currently from taxes or other departmental revenues, each property owner paying his just share. The tax rate multiplied by the assessed value equals the tax budget. To set an arbitrary tax rate means merely that, to finance the costs agreed upon, the assessed valuation of each taxpayer's property may be raised.

The extension of the pay-as-you-go policy in financing improvements of a recurring, non-revenue-producing nature as well as those having a short life, in order to obviate the loss to the city from debt service, would be a substantial argument for the removal of such tax limits.

Fourth, legal and practical bond limits must be recognized.

Detroit has a charter limit of 9 per cent of its assessed value for bond issues, further classified as to purpose. Schools and library are not subject to the charter limits. The Michigan laws permit a 10 per cent maximum debt, also exclusive of schools. These limits are both exclusive of a 2 per cent additional margin for subways. Under the charter limit, the city may today issue over $100,000,000 of bonds.

This margin, however, is practically nullified through a more stringent law enacted by a foreign state. The so-called New York 7 per cent law, which limits to 7 per cent of the assessed valuation of any city the amount to which funds of trust companies and others may be invested, reduces Detroit's margin for further indebtedness at the present time to $36,000,000. This law affects Detroit because New York is today the market for our municipal securities and there is no immediate likelihood of a new market being created.

Thus it is necessary in planning public works and extensions to limit the total to the practical, rather than legal margin available. This is not a condition unique to Detroit, but may have equal

application in your city. In planning improvments it is essential that the available funds should be used to best serve the welfare and interests of the community. Certain features of the New York law should be changed, in fairness to all cities, but there is small hope for its modification.

Whether there is need for such bond limitations will remain a matter of personal and community opinion, but it is certain that there is more justification for bond limitations to be established by the state or the community than tax-levying restrictions. Provision for amending the limit when necessary, by popular vote, overcomes most of the difficulties.

Fifth, to assure that the burden of the cost of government is borne as equitably as possible, the assessment of property should be uniformly upon a 100 per cent basis of current market value.

As an aid in the very important work of assessing the hundreds of millions of dollars of real property in our cities today, tax maps and land value maps are essential, and our engineers can contribute effectively by furnishing such maps and keeping them up currently.

Sixth, it is possible that new sources of revenue should be called upon to supplement the general property tax, and offer a measure of relief to real estate.

In this connection, consideration should be given to the possibility of extending the principle of the special assessment more generally. Some cities have extended the principle to the financing of parks and other improvements, and even to certain commonly accepted current services. New York and Detroit have proposed recently to finance a portion of the cost of subway construction by this means. The actual application of the principle for this purpose, however, seems today more likely of realization in Detroit than in New York.

Seventh, the best thought of the profession must continue to be given to the elimination of waste in the conduct of the government.

Civic groups and agencies everywhere point out that there is waste in our state and local governmental units. It is the opinion of your Committee that a certain amount of "red tape" is necessary in government, as a protection to the taxpayers generally, which is not true of private business. This, however, does not condone unnecessary waste due to faulty governmental organization or antiquated methods and machinery for the performance of public services. It is undoubtedly true that there is too much government, and too many governments. These faults and the improvement of personnel and practices are being remedied, and the progress made already this century constitutes one of the inspiring hopes of our ability to govern ourselves.

Could adequate comparative tests be made, it seems probable that the major cities would rank favorably with most industries in the effectiveness of administration. Our Society has long been apprised of the very large economic losses existing in industry, and of the many hundreds of millions which are being saved through the committees on standardized practices under the able direction of Secretary Hoover.

Similar efforts, though on a smaller scale, are being applied in most of our cities today, through official and non-official committees of citizens having only the public welfare at heart.

The members of the Society, whether office-holders or not, must give heed to and assist in these efforts.

Eighth, and finally, though it is appreciated that the aids to a solution have not been exhausted, it may be suggested that a counter-spirit must be built up with the people to demand less of their governments and a greater freedom of individual action in performing desired services. One phase of this spirit will be a reduction in the number of laws the representatives in our legislative halls are called upon to enact at each session. There is great need of making existing legislation more uniform and universal among the several states and cities, and the members of the Society can be of materal assistance in this task.

The foregoing is from a report to the 1925 meeting of the American Society for Municipal Improvements.

THE WORLD'S GREATEST HIGHWAY—WIDER WOODWARD AVENUE

By Leon V. Belknap, Road Engineer-Manager for Oakland County, Pontiac, Mich.

(Editor's Note: The following interesting article is reprinted from a recent issue of "Michigan Roads and Pavements.")

Between Pontiac and Detroit there is rapidly being completed a pavement that is very properly called the World's Great-

est Highway—Wider Woodward Avenue. It is an undertaking that is immense—immense in preparation, immense in size, and still more immense in the effect it will exert upon the whole great district northward from Detroit that will be served by it.

Picture a pavement 44 ft. in width, of 9-in. concrete, drained with storm sewers and catch basins, with a curb and gutter, and equipped with 8 ft. of parking space at each side, running through a landscaped roadway 100 ft. in width. That would be a splendid road, one that might be viewed with pride by any commonwealth that built it. But that is only one-half of Wider Woodward Avenue—which, when completed, will consist of two such roadways, running parallel, with street car lines between. One of these 44-ft. stretches of pavement has now been completed with one-half in use and other half nearly ready for traffic. It extends from the Eight-Mile road, the northerly limits of Detroit, through Royal Oak, Troy and Bloomfield townships to the southerly limits of Pontiac, a distance of 13 miles. Only in the village of Birmingham, where already a wide pavement exists, has the broader highway not been completed, due to the right of way problems which arise.

Not only is this true, but the right-of-way, grading and other preliminary operations have been completed on the other parallel half of the greater highway except in that portion, about five miles in extent, where the Grand Trunk railway blocks development by its right of way. The railway thus far has moved but slowly in adapting itself to the tremendous highway enterprise. Until it has been moved to a new right-of-way, the complete highway on that side can not be finished but the state and county authorities are hopeful that this consummation will be reached in the near future.

Work upon the great undertaking has been rushed during the season of 1925, and has been concentrated upon the westerly half of the job, with traffic detoured to prevent any unnecessary delays or dangers, so that the entire 44 ft. could be completed within the present season. This has been accomplished with the single exception of the Birmingham village paving.

Hills Are Conquered

Thus there extends over the hills and through the valleys of the picturesque Oakland County scenery one-half of the world's greatest pavement — running straight and beautiful as engineering skill could make it, in the very places where 10 years ago a 16-ft. pavement was laid and thought ample for a generation; in the very places, too, where a century ago the frontiersman was making his painful way through the woods, and where the Indian had his hunting trail.

Wider Woodward Avenue is an extension of the main Detroit street of that name. It is a part of the Michigan trunk highway, M-10. It traverses one of the greatest residential developments in America, which a generation ago was a stretch of fertile farms. Now there is scarcely a cultivated farm for many miles. All this territory has been seized upon by home-seekers and subdividers and made into a beautiful development, which is rapidly being built up. Such parts of it as had not previously been subdivided have been so treated since the decision to build the highway was reached, because of the general realization of the manner in which so gigantic a highway improvement must develop the adjacent property. In Bloomfield township alone, this is not generally true. There the famous Bloomfield Hills district maintains its hundreds of large estates; among the most beautiful of the country, rivaling famous Westchester county, New York. Even there, however, some evidence is given of the general tendency to secure home-sites upon the broad highway and some of the larger tracts have been subdivided.

Outstanding Example of Engineering

Wider Woodward Avenue is looked upon in engineering and road-building circles as an outstanding example of road-making skill and of foresight in traffic planning. Unique in highway accomplishment as it is today, it is the opinion of the builder that a generation will not have passed before it will be copied in other places as the necessary solution to traffic problems on a main avenue into a large center.

Ten years ago, the old pavement on Woodward Avenue was laid. It traversed a highway that originally had been laid out 100 ft. wide. Encroachments by property owners and other conditions had reduced this considerably, some places not more than 66 ft. remaining. On this there was a double tracked interurban trolley system and numerous wire lines on poles. The narrow pavement was at that time believed to be—and rightly—a tremendous improvement. It provided the first real factor in opening up the wonderful residential country to the north of

Detroit and provided a powerful stimulus to the upbuilding of villages and cities along the way.

But as the automobile came into general use, it became apparent almost at once that the narrow pavement would not long serve its purpose. The road became known as the most dangerous one in America for the reason that it was continually crowded, its intersections were not properly planned for the increased traffic and it was beside a trolley line, which in many places, ran on the same level as the pavement, without guards between.

Congestion on this pavement rapidly became so great that many motorists refused to drive upon it, especially on summer week-ends. Tie-ups miles in length were not uncommon. Numerous accidents took place and scores of lives were sacrificed. It was in such a situation that the Oakland County Road Commission addressed itself to the problem and quietly prepared surveys looking toward expansion of the road. Efforts to secure action by the state were long and painstaking but it was not until the legislature of 1923 passed an enabling act providing for widening the road and financing the operations that real results could be obtained.

In the fall of 1923 Governor Groesbeck and Frank P. Rogers, state highway commissioner, went over the proposition and the Governor gave orders that the work proceed at once. It has never been halted since. All the intricate problems of securing right-of-way were handled by Thad D. Seeley of Pontiac, in a capable and efficient way, with an eye to securing the necessary land quickly, doing it economically and with as little litigation as possible. The construction work was placed in charge of Leon V. Belknap of the Oakland County Road Commission enginering staff and A. M. Comb, representing the State Highway Department. The work has proceded steadily in spite of numerous obstacles and perplexing problems. It has met with no unsurmountable obstacles, and it has had always behind it the unflagging interest and energy of Governor Alex. J. Groesbeck as well as of the Oakland County Road Commission. The 44-ft. pavement now opened to use is the first major result.

Wider Woodward Avenue is 13.2 miles in length, to be exact, not including the section in the village of Birmingham. It has a 200-ft. right-of-way, through which run the two strips of pavement. These are 69.2 ft. apart between the Eight-Mile and Ten-Mile roads, between the curbs with a 20-ft. sidewalk area allowed. North of the Ten-Mile road the distance between curbs is 38.7 ft.

Big Problems of Contracting

The contracting jobs on this undertaking have been immense because of the nature of the terrain, and the necessity of removing the old pavement, grading, restoring properties facing the road to proper condition, and providing drainage. This last has been taken care of without a foot of unsightly or dangerous ditches along the way.

Contracts on the road were let to the following firms:

The R. D. Baker Company had the paving contract from the Eight-Mile to the Eleven-Mile roads, for the two 44-ft. strips complete. They expect to have this contract finished this fall. They cover a distance of 3.4 miles in which it was necessary to move 105,346 cu. yds. of earth and to lay 168,162 sq. yds. of 9-in. concrete besides the curbs.

The W. H. Knapp Company had the contract for the west 44 ft. from the Eleven-Mile road to Birmingham, a distance of 4.24 miles. On this section the paving amounts to 103,300 sq. yds. and the earth removal to 33,333 cu. yds.

Betwen Pontiac and Birmingham, on both sides of the road, the White Company of Milwaukee obtained the contract, a distance of 5.516 miles. In this section 171,800 sq. yds. will be paved when completed and the firm did no excavating. The west 44 ft. of this section will be completed this fall. George Smith Company had the excavating contract on this section and will have moved 200,000 cu. yds. of earth when finished.

One of the features of the task has been the removal of the old concrete pavement, which had to be broken up and taken away. This was accomplished with breakers and steam shovels as the work progressed.

Scientific Drainage.

Through this big road development the drainage problem has been provided for in a scientific manner. Storm sewers are laid the whole distance, with special catch basins entering them. The catch basins are of a heavy type which are expected to give extraordinary service. Outlets for the sewers are provided into various community and county sewers and drains. No single section of the pavement is perfectly level, so that drainage is rapid. Torrential and long continued rains during the process of building have

proved that the drainage is ample to prevent any standing water. This drainage feature is expected to add materially to the life of the great highway, because it removed the element of frost damage to the concrete work, which has been considerable on those roads not so well equipped for removing water. Bartling & Dull of Pontiac have had the contracts on the drainage work, installing pipes running from 12 to 36 ins. in size.

Among the other major problems connected with the highway project has been that of intersections and cross-overs. This has been solved in the following manner: All important street intersections are at grade with the new pavement. It may at some later date be necessary to separate grades at important crossings, but this is not contemplated at present. Cross-overs between the two strips of pavement are provided for at every third intersection, approximately, and all streets have an opening on the new pavement adjacent to intersections. Where more than one street intersects Woodward Avenue at a given point, traffic islands are provided and traffic moves in a rotary fashion in passing on and off the big highway.

On each of the wide strips there are four lanes for traffic, marked off by longitudinal joints, while transverse joints are 50 ft. apart, half an inch wide and 9 ins. in depth. The crown is 5½ ins. and at each side is an 8-ft. graded shoulder of gravel for parking purposes.

The curb and gutter section is 32 ins. wide, with a 4-in. height of curb, 6 ins. thick at top and 12 at the bottom, while the gutter section is 9 ins. in thickness. The curbs are designed to permit easy passage to the marking sections. Concrete used in construction work is 1:2:3½ mix.

To Be Completely Landscaped

Eventually this tremendous highway will be completely landscaped. Even at present it lacks the raw appearance that might be associated with such a project, because of the care that has been taken in restoring the beauty of homes and estates through which the right-of-way had to be widened. Trees and shrubs have been moved and replaced, stone walls put back in condition on their new location, estate entrances preserved, private drives restored to their original appearance and as far as possible the finest landscape effect maintained. Where sharp curves had existed previously, broad, gentle swings now take their place, adding much to the pleasantness of the view.

Telephone lines have all been placed in conduits, removing the unsightly poles and electric transmission and service lines will be placed in the middle section, serving jointly as center pole construction for the trolley line. Maximum grade is 6 per cent and all curves have been reduced to one degree.

Enginering problems have naturally been considerable, although only incidental to getting the results. Two small lakes had to be filled in, and many cuts and fills were necessary. On Stinchfield Hill, for instance, huge cuts were made and curves eliminated. One curve there is 1,900 ft. long, a third of a mile, held to one degree. It was necessary, too, in order to make way for the road, to remove parts of several cemeteries, which involved delicate negotiations in the first place and careful work in the second to accomplish the task. Big estates had to be cut down along their frontage and restored to their former appearance; whole business blocks taken back from the road line, and hundreds of houses moved and set up on other lots.

Lakes Filled In

Questions of foundation were numerous, such for instance as that presented in filling the lakes. These had oozy bottoms of muck, which presented a danger of later settling or slipping. To obviate this, the muck bottoms were pushed aside and fills made with earth and gravel to provide a solid footing.

Grading has been handicapped, too, by the fact that service had to be maintained on the D. U. R. trolley lines. For this reason, only one set of tracks could be removed at a time, service being kept up by cutovers to the single remaining line which was maintained until the new grade could be established and the new tracks laid. In many cases earth had to be moved across these tracks, adding to the difficulty and delay. Still another impending factor was that during a large part of the operations the motor traffic had to be continued on the old pavement. Only in midsummer of 1925 was this discontinued and detours established at Royal Oak and Pontiac. Even during a part of this ensuing time some of the more important and necessary traffic has had to be admitted to the road.

In spite of all these problems, handicaps and drawbacks, however, the unremitting zeal of officials and contractors alike has pushed the progress of the project so that the promises as to completion have been kept almost without ex-

ception. Parts of the pavement were thrown open for use as rapidly as it was safe to do so, and immediately have given evidence of what may be expected when the whole project is completed. The floods of automotive traffic which have passed over the road in the past will be small compared with what the new pavement can and will accommodate.

To Meet Enormous Traffic Demand

Traffic counts kept on various sections of the old pavement have shown as high as 21,000 vehicles passing in a single 24-hour period and a daily average of 14,000. This was about all the road could handle —and it could not handle that number safely. But with a surface capacity about six times as great, in driving surface, and safety multiplied hundreds of times, it is confidently believed that not many years will have passed before the broader highway will be filled during the week-end rushes out of the big metropolis into the home and play places of the northward country.

Residents of city and county along the right of way are expecting that tremendous expansion will take place as soon as the entire roadway is ready, and even before. The opening of one-half of the road is believed to be the signal for thousands of persons to seek home-sites in this district. But not only is Pontiac, Birmingham, Royal Oak, Ferndale and Berkley to be the recipients of the direct benefit, and the country between them, but the effect of the development resulting is already being felt far to the northward.

The new highway will terminate at Pontiac, which thus becomes the terminus for distribution of vast quantities of traffic. From this city improved highways lead off in every direction to the lake country, the farming districts, the picturesque hills of northern and western Oakland, to the Thumb district, the Flint and Saginaw Bay country, and on up to the central and northern parts of the state. For all of these trips, Pontiac will be the distributing point when the highway is finished.

To meet this situation ample plans have been laid by the city of Pontiac for parallel routes through the municipality, which will prevent congestion at the end of Wider Woodward avenue. Three such avenues are now in contemplation and will be completed within a year or so. Saginaw street, in the city, is to be widened and paved, Willow avenue extended and paved, and Paddock street extended, widened and paved. This will take care of the through traffic as well as that bound for Pontiac city, with as little delay and congestion as possible.

Thus the greatest highway project of the world is being brought to a successful accomplishment. Unless the Grand Trunk Railway proceeds with even more delay than is counted on, the complete wider Woodward pavement, an outstanding example of fearless and foresighted grappling with a great development need, will be completed and in use, on both sides, within another year. It will constitute a worthy monument to the enterprise and zeal of the state and county officials engaged upon it, but even more so to the communities, which gave such a wholehearted support as to bring it into being.

DAY LABOR IN PUBLIC CONSTRUCTION

By J. H. Ellison, Vice-President, Winston-Dear Co., Contractors, 801 Globe Bldg., Minneapolis, Minn.

(Editor's Note: The following address by Mr. Ellison was delivered at the 1925 meeting, at Des Moines, Iowa, of the American Society for Municipal Improvements.)

I very much appreciate this opportunity to place before you some facts, and some conclusions drawn from those facts, concerning "day labor" extension and expansion in the United States.

We know that no industrial movement, which is not economically sound, can endure indefinitely; but often an unsound movement or measure may have quite a lease of life because its operation is not generally understood. The association which I represent, the Associated General Contractors of America, feels that it is of the utmost importance that the situation be placed squarely and as accurately as possible before the vitally interested public.

Following the time-honored custom of the preacher, it has seemed to the writer, advisable to begin with a "text." The text is multiple in character and appears to afford a reasonable foundation for what he has to offer.

Extract from the "Platform of the Republican Party" adopted by the National Republican Convention—Cleveland, 1924.

"The prosperity of the American Nation rests on the vigor of private initiative which has bred a spirit of inde-

pendence and self-reliance. The Republican Party stands now, as always, against all attempts to put the Government into business. American industry should not be compelled to struggle against Government competition."

Extract from the "Democratic Platform" adopted by the Democratic National Convention—New York, 1924

"We oppose the extension of bureaucracy, the creation of unnecessary bureaus and federal agencies and the multiplication of offices and officeholders."

Extract from President Coolidge's address of acceptance—August, 1924:

"I favor the American system of individual enterprise, and I am opposed to any general extension of government ownership and control."

Extract from President Coolidge's address at exercises commemorating 150th anniversary of first continental Congress —Philadalphia, Pa., Sept., 1924:

"If the people lose control of the arteries of trade and the natural sources of mechanical power, the nationalization of all industry could soon be expected. Our forefathers were alert to resist all encroachments upon their rights. If we wish to maintain our rights, we can do no less."

"It is very difficult to reconcile the American ideal of a sovereign people capable of owning and managing their own government with an inability to own and manage their own business."

"We are too solicituous for government intervention, on the thory, first, that the people themselves are helpless, and second, that the Government has superior capacity for action. Oftentimes, both of these conclusions are wrong."

Extract from an address by President Coolidge at the dedication of a monument to the dead of the American Expeditionary Forces at Washington:

"You want a free and fair opportunity to conduct your own business and make your way in the world without danger of being overcome by a government monopoly. When the government goes into business it lays a tax on everybody else in that business, and uses the money that it collects from its competitors to establish a monopoly and drive them out of business. No one can compete. When the government really starts into a line of business that door of opportunity is closed to the people. It has always been an American ideal that the door of opportunity should remain open."

Extract from an address by Secretary of Commerce, Herbert Hoover:

"I would like to see an independent investigation in the relative cost of construction of public work departmentally as opposed to contract. I believe that there would be here demonstrated a great public waste. It is my belief, as an engineer, that construction by contract of public works makes for national economy."

From an article in the Nation's Business for October by Admiral Leigh C. Palmer, President, Emergency Fleet Corporation, I quote the opening paragraph:

"A highly competitive international shipping line under government operation or control and supervision is at a great disadvantage as compared with a line operated under an efficient private commercial corporation."

At a meeting of the Executive Board of the Associated General Contractors of America, held at the Hotel Washington, May 20, the following statements were made:

That the Corps of Engineers of the United States Army were ignoring and clearly intended to continue to ignore the plain intent of the Arlington Memorial Bridge Bill in preparing to construct that bridge with their own forces and method.

That they were in this case simply following a system which they have applied in constantly increasing ratio from year to year during the last quarter century, viz. Of doing as much as possible of the construction work placed under their charge with equipment purchased for and owned by the United States, operated under the "day labor" system with man power employed by them.

That the results of numerous "day labor" undertakings, as recorded in their own published records, show conclusively that they are either utterly incompetent to make advance estimates of the cost of public work (which the A. G. C. of A. does not believe) or that such work under their direction and by that method shows gross extravagance in construction, vide.—The record of a bridge built by them under this method at Washington, D. C., the Francis Key Bridge, which was estimated to cost $1,000,000, and which actually cost $2,350,000. Also the Wilson Dam and substructure of the Power House at Muscle Shoals, Tennessee, which was estimated in 1916 to cost $10,700,000, on which has been expended to date, $32,500,000, is still incomplete and will

require (as estimated by competent engineering authority) an expenditure of approximately $8,000,000 additional to finish fully. This statement of expenditure made and still to be made does not take into account capital expenditure for equipment used on the work, much of which will have little value to the United States after this work is done. If time permitted, many additional instances could be cited.

That, since 1900, when the Engineer Corps did about 12 per cent of the total work done under their direction by the "day labor" method and 88 per cent by contract, by 1924 those figures had changed to 75 per cent by the "day labor" method and 25 per cent by contract, and that further, the total equipment owned and operated by the Corps in 1900 represented a capital expenditure of less than $5,000,000; whereas, in 1922, the amount of capital expenditure for such equipment had increased to over $55,000,000.

The contention in brief of the Associated General Contractors of America is that the result of this system is to enormously increase the costs of these operations to the tax-payers, that it tends to eliminate competition entirely, that it violates the principles laid down by both of the great political parties, as expressed in their platforms of 1924, and as also expressed on numerous occasions by the President of the United States, both in private and in public; the frequently announced attitude of the Chamber of Commerce of the United States; the reiterated views of the Secretary of Commerce; and of many other Government officials; and held by thoughful men of all sections of this great country, to-wit: That the Government should not engage in business in competition with private enterprise. These statements were and are aimed at a system and not at the United States Engineer Corps as individuals.

An emphatic and heated denial of all these statements has been made by General Taylor, Chief of Engineers, and Colonel Sherrill, Executive Officer of the Committee on Public Buildings and Grounds of the District of Columbia. Except that it may be difficult to prove the "intention" of the Corps regarding the method of constructing the Arlington Memorial Bridge, every statement made can be substantiated by the published records of the Corps. The situation is already a matter of serious concern to the people of the United States and to the extent to which the Associated General Contractors of America are able to forecast, it threatens to become still more serious.

Passing from the activities of the U. S. Engineer Corps, which is given first place in the paper because it occupies nationally the most commanding position of any group directing public construction, it is unquestionably true that the use of the day labor method in this class of work has been constantly increasing throughout our states, municipalities and their boards and commissions which have to do with the direction of public work.

For several years the State of Michigan has constructed and paved most of its highways by this system. In the writer's own City of Minneapolis, all of the street paving and all of the sewer work for many years past, the two most recently constructed important bridges over the Mississippi River, and sundry other public works have been built by the "day labor" method, and the City has already inaugurated the construction of a third bridge across the Mississippi River by the same method. The writer will not try your patience in the attempt to enumerate more than a small part of the operations with which he is acquainted in which this method is invoked.

The following list which is of course in a number of cases more or less approximate, owing to the impossibility of getting scrupulously accurate cost records, is fairly illustrative of the general condition.

The writer has been asked why the comparison between actual "day labor" cost and the contractor's bid is not used in all these citations. The answer is that in a majority of the instances cited, no bid from contractors was asked for or received.

The most ardent proponents of the "day labor" plan are the most persistent opponents of receiving bids on such work, because they know that one of two results would follow. Either that the cost of the project would be shown to be so great as to cause its abandonment, at least temporarily; or, that if they decided to construct with their own forces the comparison of the actual cost—if honestly and accurately disclosed—with the contractor's bid would operate to destroy the "day labor" method. Many of the supporters of this method are actuated by political rather than economic motives.

Suffice it to say, that this system is

DAY LABOR COSTS IN ACTUAL CASES

Name of Project	Engr's Est. or Contr's. Bid.	Cost by Day Labor	Pct. of excess cost	Probable loss to public
Two California Highways (a)	117,000	160,000	37	43,000
(b)	43,000	81,000	88	38,000
Gila Dam, Arizona	800,000	2,000,000	150	1,200,000
Municipal Garage, Detroit, Mich.	550,000	694,000	26	144,000
Michigan Highways, 8 miles in Genessee County..	280,000	400,000	43	120,000
Watervliet (Mich.) High School	150,000	210,000	40	60,000
Wyandotte (Mich.) School	884,000	1,145,000	30	261,000
Bay City (Mich.) Schools (2)	930,000	2,217,000	138	1,287,000
Munising (Mich.) High School	285,000	415,000	45	130,000
Levee Construction—Third Mississippi River Dist. —1918-1923, 12,000,000 cu. yds.	4,038,000	5,154,000	27	1,116,000
Mississippi River Bridge, Minneapolis, Minn.	450,000	1,000,000	122	550,000
Ashland Reservoir, Denver	104,000	120,000	15	16,000
Sixteenth Street Viaduct, Denver	420,000	668,000	60	248,000
Twenty-three Reclamation Projects	63,000,000*	122,000,000*	94*	*59,000,000
St. Louis Sewers	383,000	426,000	11	43,000
Francis Key Memorial Bridge, Washington, D. C.	1,000,000	2,350,000	135	1,350,000
	73,434,000	139,040,000	88	65,606,000

* In fairness to the Reclamation Service it should be recognized that some of the original plans on which the $63,000,000 estimate was based were modified and the work increased, but this by no means accounts for the overrun of 94 percent.

wide-spread and that there is probably no state in the Union in which it is not in use to a greater or less extent. The Associated General Contractors of America allege, and in many instances proof of the truth of the allegation is available, that almost invariably the cost to the public of work done by this method is in excess of that which would have obtained if done by contract. It is not always possible to prove this for two reasons. First, that in many instances no bids from contractors are asked for or received, and second, in many cases no accurate cost record of the work is obtainable.

While this situation is a matter of concern to responsible contractors, it is of infinitely more concern to the tax-payers. The increased cost of work by this method must of necessity increase the amount of direct tax, and it has its effect indirectly in that it causes a loss to the government, state or municipality, of the tax which would have been paid by private individuals on the income from and equipment used in such work.

It has been charged that the attempt of the Associated General Contractors of America, to give the fullest possible information to the public regarding the effect on taxation of the constantly increasing volume of public construction performed by the "day labor" method, is inspired by "selfish interest."

To the extent that members of this Association hope to benefit by a return to what it regards as the reasonable and proper method of constructing needed public works, we concede the truth of this charge. We are assured, however, that the benefit to be derived from such action will accrue in much larger measure to the general taxpayer. Any and every individual in the United States, who is not a dependent on an individual or family, or is not a charge of and upon the state, is either directly or indirectly a taxpayer.

Why "Day Labor" Method is Unsound

There are at least four important reasons why the "day labor" method is generally unsound; as follows:

1. It is contrary to the generally accepted view that the Government should not engage in business in competition with private enterprise when and where private enterprise and initiative is available.

2. It is socialistic in tendency.

3. It makes possible the organization of a machine, which will assure the continuing political control of all activities of that department of government, by the agency of that government using this method.

4. It fails to recognize a well established principle which demands the employment of professional skill when and as such skill is of value. We do not employ an engineer to treat us in case of illness, an architect to conduct our cases in court, or elsewhere, when legal knowledge is requisite, a doctor to locate our railroads, nor a lawyer to design our buildings.

The A. G. C. of A. affirms that the business of construction has become a profession, and that the professional skill of available contractors is such that they can in general assume charge of public construction under the supervision of the

engineer or architect, and so carry on the work as to save money for the taxpayer; meantime securing a greater or less compensatory profit for themselves.

It is further claimed that in the event that the contractor, through incompetence, or for any other reason, does not receive a sufficient price for his work to secure him against loss, he bears that loss, whether individually or through his bond, and that it does not fall upon the general taxpayer. Where the cost of work on the "day labor" plan exceeds the advance estimate, or the appropriation, or both, such excess is of course passed along to the general taxpayer.

The New York Commercial has been so impressed with the threat of this epidemic as to publish a series of twelve *front page* articles upon the subject.

These articles began in the issue of September 22nd, and ended with that of October 5th. Subsequent issues have additional matter of value on this point.

Those of you who are interested can obtain reprints of the articles by application to the New York Commercial.

If the contractor has nothing of value to offer the community in the conduct of his business it is certainly time for him to find it out and either to retire from active business as an obsolescent and useless burden on the public or to learn some new occupation in which he can be of service and incidentally avoid becoming a charge upon the state.

Is it possible that the skill developed by years of intensive training, which an overwhelming majority of the responsible contractors now operating have undergone, has no value in producing, through intelligent supervision by trained men of individual initiative, better methods, better workmanship and better progress in all lines of construction? If this is possible much of the work of our public schools, universities and colleges—especially that of our technical schools—is wasted.

It seems quite reasonable to expect that the first question that will be asked by anyone interested in this subject will be—"Assuming that the conditions exist as stated, what is the remedy?"

The writer suggests as a preliminary step the general acceptance and adoption of the following declaration of the "Taxpayers Association of Hennepin County," Minnesota, as quoted from "The Taxpayer" of September, 1925.

Suggested Course To Be Followed Before Actually Engaging in Work of Public Construction

In order to assure, and as far as possible guarantee, to the taxpayer, that all municipal work of public character will be done at the least possible cost compatible with good workmanship and efficiency, *The Taxpayer* suggests that in conformity with the spirit of Chapter 274, Laws of 1921, the following steps or proceedings be taken before any public work be actually started.

1. The due authorization of the work to be performed, by legislative or other appropriate action, on the part of the body or agency clothed with the power and charged with the responsibility to order and direct the doing of public work, and having the means of providing for the payment thereof.

2. The preparation of competent engineers or architects, or both, of plans and specifications, with accurate quantity surveys and an approximate estimate of cost; and, with competent legal co-operation, of a suitable form of contract.

3. If and when the necessary appropriation has been made by the proper appropriating body and the funds are in the hands of the authorized disbursing agency, or will be available when required, advertisements for bids should be published, in manner provided by law, in proper form, setting forth:

(a) The qualifying requirements for bidders.

(b) The time when, the place where and the conditions under which copies of the plans, specifications, quantity surveys, form of contract and other information may be obtained.

(c) The time when, and the place where, bids will be received, publicly opened and read.

4. The prompt award of a contract to the lowest responsible bidder, who should be required to furnish a satisfactory and sufficient bond for the performance and completion of the work within the time and for the gross amount, or at the unit prices, named in his proposal—except and unless the agency, directing such public work, may for sufficient cause elect:

(a) To reject all bids and readvertise the work for other proposals; or

(b) If, for good reasons given, it be considered that the work cannot be let by contract for a price as low as it can be done by the agency in question, to reject all bids and proceed under the method as "the day labor system."

5. In the event that alternative "(b)" in Section "4" above is adopted, an accurate record should be kept, showing, properly classified, all expenditures of every kind and nature incurred in the prosecution and completion of the work, including the cost of all material and supplies, engineering, architectural and other services, overhead, rental and depreciation of equipment employed, insurance and any and all other items of cost and expense entering into the work.

6. A summary of such expenditures should be published in the official newspaper of the city within 60 days after the completion of the work; and a transcript of the itemized detail should be promptly procurable from the recording officer by any interested taxpayer requesting the same, upon the payment of a reasonable charge for copying."

The American Society for Municipal Improvements must of necessity be interested in taxation—must earnestly desire to know that the taxpayer's money is being expended in such manner as to produce commensurate value.

The examples of waste due to this cause that are listed in this paper are only a few of those recorded by our Association; but they are sufficient to show conclusively that this waste exists and that it is widespread in operation and effect.

A custom which requires demagogueism, subterfuge and, on the part of some of its proponents, absolute falsehood in its defense cannot long endure when the facts are public property.

It is the purpose of our Association to give these facts to the interested public as rapidly as they can be collected and verified. We expect this to result in a demand in no uncertain tone for the abandonment of this practice whenever and wherever it can be demonstrated to be uneconomical—and that this demand will be voiced by that most directly affected group—the taxpayers.

The writer is assured that your interest in this situation will inspire a careful study of the general conditions which prevail, and your untiring efforts to secure the adoption of measures both nationally and locally to check this inexcusable waste.

"Wherefore do you spend your money for that which is not bread and your labor for that which satisfieth not?"

MICHIGAN ENGINEERS FOR INDEPENDENT ORGANIZED ACTIVITY

That the Michigan Engineering Society as a concrete organization, with the cooperation of engineers' clubs in the various cities of Michigan, can accomplish more and achieve more constructive results than by affiliation with the American Association of Engineers, was emphasized at their meetings in Grand Rapids, October 28, as reported in "Michigan Roads and Pavements."

The society had previously taken a mail vote upon the question of withdrawing from the A. A. E., the result being emphatically favorable. The cause of this was that the engineers of the state did not feel that the Michigan Society was doing justice to itself and the engineering profession in this state by such affiliation, and it was the consensus of opinion that by independent activity the Michigan organization could be materially strengthened and its work productive of better results. While the vote taken by mail was decisive, it was recognized that some action should be taken officially by the organization relative to operation under the present constitution.

In order to proceed in regular form in this respect State Highway Commissioner Frank F. Rogers, one of the original members of the organization, offered a resolution that the society continue to operate under the existing constitution as provided previous to the affiliation with the A. A. E. and that the present officers continue until the next regular election, according to the provisions of the by-laws. This resolution was unanimously adopted. It was also decided upon motion that the action taken by the board of trustees providing for participation in the conference of engineers of the state to be held in Detroit be approved.

Much of the discussion at the Grand Rapids meeting was relative to the Detroit conference and its effect upon the Michigan Society as an entity.

At the afternoon business session G. C. Dillman, Deputy Commissioner, Chief Engineer of the State Highway Department, was one of the principal speakers.

Mr. Dillman described in detail the activity in growth and the importance of the Michigan Engineering Society, and declared that its success and influence were based entirely upon honest effort and that there must be confidence among the engineers themselves in order to real-

ize the ideals which the organization stands for.

Dean Bissell, of the Engineering Department of M. S. C., followed Mr. Dillman. He urged that definite plants be taken to proceed with the old-time spirit, and declared that the organization could be a medium for self-improvement and that the time is not far away when the society would become a power for the principles it represents. He also declared that modern times are developing big problems which the organization of engineers in this state could take hold of and help to solve in a practical, helpful and scientific manner.

H. A. Shuptrine, former president, and bridge engineer of Wayne County Road Commission, expressed the opinion that close co operation with the Detroit Engineering Club in the matter of the February conference would have a beneficial effect in the strengthening of the state society. Mr. Shuptrine, as chairman of the general committee having in charge the arrangements for the conference, emphasized the advisability of the organization of clubs in every city in the state and urged that the state society foster such organizations and give them the constructive co-operation of the state organization. Mr. Shuptrine stated that the Michigan Engineering Society was founded upon traditions that have aided the members to keep together and work for the ever-present purpose of achievement. He explained that affiliation with the national organization had not been acceptable, and as that affiliation was now severed, that the voice of the profession in Michigan could be made articulate through the Michigan organization and that it was necessary that the engineers of the state should have a medium of expression, and it was his opinion that the state society would serve as such a medium.

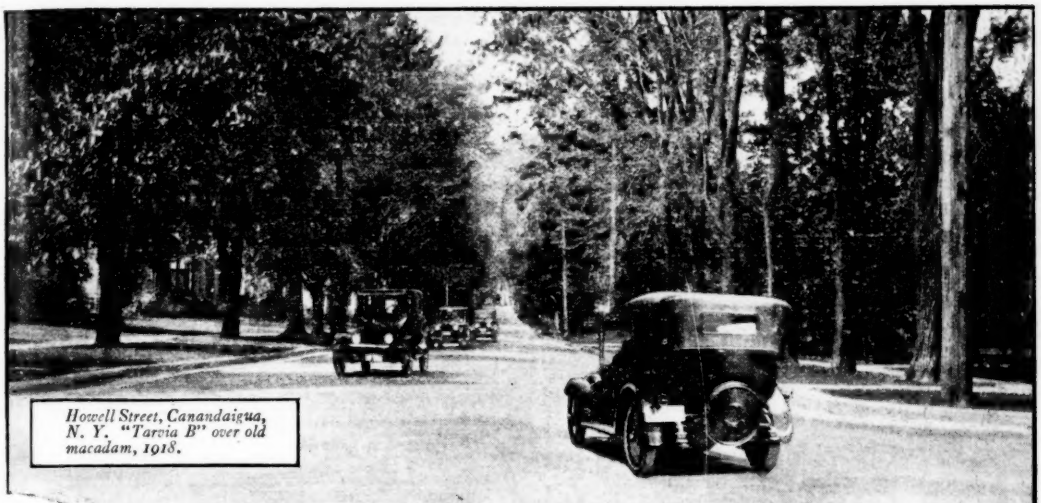
ROAD SHOW NEWS

The perfection of a national highway system embracing 50,000 miles of improved roads and connecting all the states and the larger cities, preliminary steps toward which were taken at a recent conference of Federal and state highway officials in Washington, will be one of the matters fully discussed at the convention and machinery exposition of the American Road Builders' Association to be held in Chicago, January 11-15, next. The new national highway system is to be perfected by the government in conjunction with the states through Federal aid. The routes will be marked and operated by the states.

On account of the great number of Federal, state, county, township and city highway officials, engineers, contractors and machinery and material men attending the convention, President W. H. Connell of the American Road Builders' Association, has divided the program of the convention into two divisions, one especially attractive to engineers and highway officials, and the other to contractors and- machinery and material manufac turers and dealers. Frank Sheets, state highway engineer of Illinois, and treasurer of the American Association of State Highway Officials, is in charge of program for highway engineers and officials and S. M. Williams, vice president of the Autocar Sales and Service Company, is in charge of the contractor's program.

Civic organizations as well as individual highway interests are urging state and county highway engineers and commissioners as well as city and town officials to attend the Chicago convention and show in order that they may study the latest developments in road construction and maintenance, observe the machinery and equipment in actual operation and learn to apply the most advanced methods in the solution of their local problems. In recent years, highway expenditures in the United States have amounted annually to more than one billion dollars. The highway industry has become the third greatest in the nation. How completely the highway industry affects the lives of all people will be brought out during "Good Roads Week" beginning Jaunary 11, 1926, to be celebrated throughout the country in conjunction with the American Road Builders' Association and its convention and exposition.

The annual road builders' banquet, which will be attended by some of the most noted road builders of this and other countries, will be held Wednesday evening, January 13 at 7 o'clock in the Gold Room at the Congress Hotel. Invitations to participate in the banquet program have been extended to several men prominent in the national government. This banquet affords an occasion during the convention for highway engineers and officials from all over the country to assemble for entertainment and a general good time.



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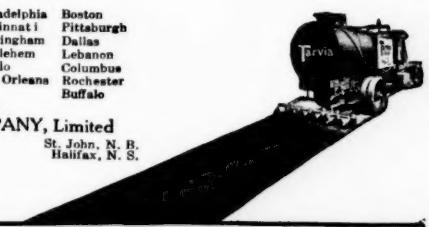

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